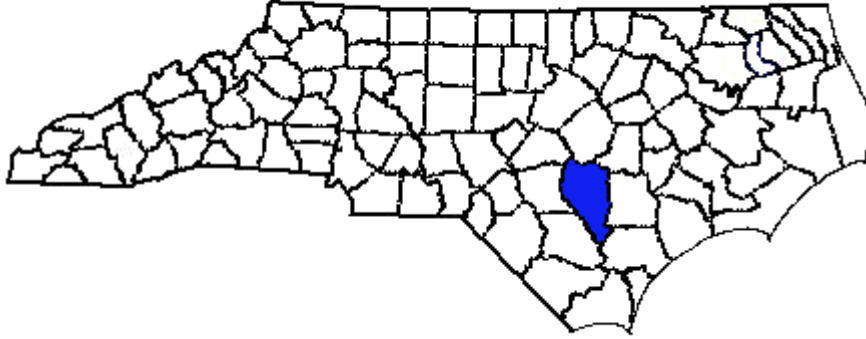


ANNUAL REPORT FOR 2000



**BULL FARM MITIGATION SITE
SAMPSON COUNTY
PROJECT NO. 6.24900T
TIP NO. U-508**



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Natural Systems Unit & Roadside Environmental Unit
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December 2000

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BULL FARM MITIGATION SITE 2000 REPORT – EXECUTIVE SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at the Bull Farm Mitigation Site. The site was constructed in 1995. Vegetation monitoring was discontinued in 1999. Monitoring activities in 2000 represent the fifth year of hydrologic monitoring. The site must demonstrate hydrologic and vegetation success for a minimum of three years or until the project is deemed successful.

The site contains twenty-two groundwater monitoring gauges in the restoration areas, two gauges in reference wetland areas, and 21 vegetation plots.

This year, rainfall data has been acquired from two sources. From the beginning of the growing season to June, the daily rainfall on the gauge data graphs was recorded at a rain gauge in Clinton (Sampson County), maintained by the NC Climate Office. Since June, an infinity rain gauge installed on the site has provided local rainfall data.

Hydrologic monitoring indicated that the site is continuing toward success. Under normal conditions for 2000, eighteen of twenty-two gauges met jurisdictional hydrologic success for at least 12.5% of the growing season, while only one gauge met success less than 5% of the growing season. The two reference gauges met success but were not part of the total.

The areas around Gauge 102 and 119 have not been showing success; based on the current conditions (elevations and soils) on the site, NCDOT doesn't anticipate improvements in these areas.

Based on the monitoring results for this growing season and previous years, NCDOT proposes to discontinue hydrologic monitoring and close out the site. Part of this proposal is to remove a yet to be determined credits from the site due to the lack of success around Gauges 102 and 119.

1.0 INTRODUCTION

1.1 Project Description

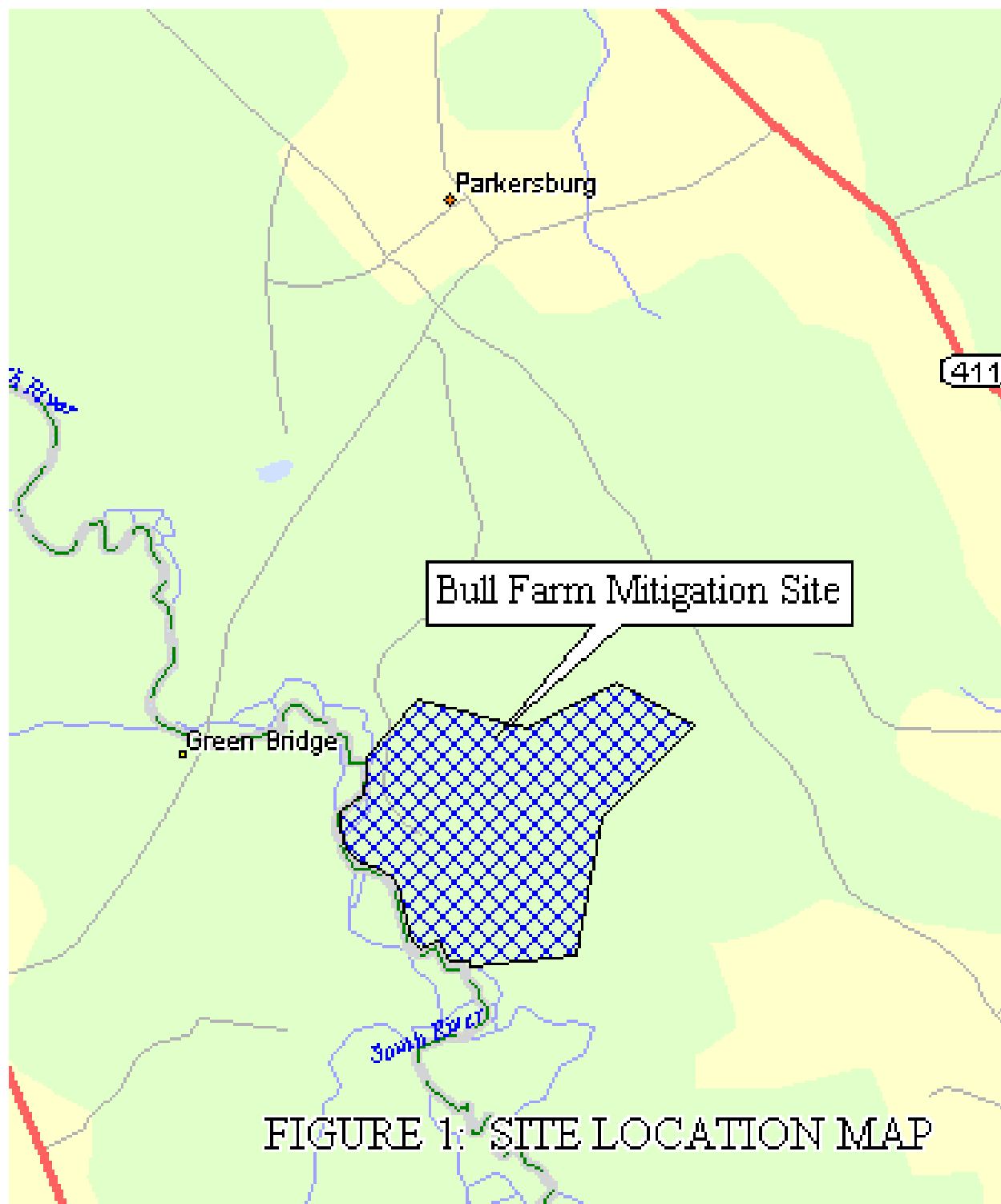
The Bull Farm Wetland Mitigation Site is located in Sampson County adjacent to the South River, a tributary of the Cape Fear River (Figure 1). It is accessible by SR 1208. The site encompasses approximately 425.5 acres and is designed as a mitigation site for the Elizabethtown Bypass (R-512), Fayetteville CBM Loop (U-508), and the Kenansville Bypass (R-2211).

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of three years or until success criteria are fulfilled. Success criteria are based on federal guidelines for wetland mitigation. These guidelines stipulate criteria for both hydrologic conditions and vegetation survival. The following report details the results of hydrologic monitoring during 2000 at the Bull Farm Mitigation Site. Vegetation was discontinued in 1999. Activities in 2000 reflect the fifth year of monitoring following the construction of the site. Included in this report is the analysis of hydrologic monitoring results as well as local climate conditions throughout the growing season.

1.3 Project History

Summer 1995	Construction
Sept.-Oct. 1995	KG Shearing/Piling/Bedding/Ripping/Discing
Jan.-Feb. 1996	Tree Planting
February 1996	Monitoring Gauges Installed
March 1996	Aerial Herbicide Treatment
March – November 1996	Hydrologic Monitoring (1 yr.)
October 1996	Vegetation Monitoring (1 yr.)
March – November 1997	Hydrologic Monitoring (2 yr.)
Summer 1997	Ditches Plugged and Fish Pond Excavated
October 1997	Vegetation Monitoring (2 yr.)
March – November 1998	Hydrologic Monitoring (3 yr.)
October 1998	Vegetation Monitoring (3 yr.)
March – November 1999	Hydrologic Monitoring (4 yr.)
November 1999	Vegetation Monitoring (4 yr.)
March – November 2000	Hydrologic Monitoring (5 yr.)



2.0 HYDROLOGY

2.1 Success Criteria

In accordance with federal guidelines for wetland mitigation, the success criteria for hydrology states that the area must be inundated or saturated (within 12" of the surface) by surface or ground water for at least 12.5% of the growing season. Areas inundated less than 5% of the growing season are always classified as non-wetlands. Areas inundated between 5% - 12.5% of the growing season can be classified as wetlands depending upon other factors, such as the presence of hydrophytic vegetation and hydric soils.

The growing season in Sampson County begins March 18 and ends November 11. The dates correspond to a 50% probability that temperatures will drop to 28° F or lower after March 18 and before November 11.¹ The growing season is 237 days; therefore the optimum duration for wetland hydrology is 30 days. Also, local climate must represent average conditions for the area.

2.2 Hydrologic Description

Historically, wetlands on the tract were created by a high water table and periodic flooding of the South River. A network of ditches existed to drain the farm fields. After an extensive study of the site's hydrology, it was concluded that blocking the drainage ditches would elevate the groundwater to a level that would saturate the soil stratum within the required twelve inches. It was predicted that this, in addition to surface water and runoff would be sufficient to restore wetland hydrology.

Twenty-four groundwater monitoring gauges and two rain gauges were installed in 1996 (Figure 2). Two of the gauges were installed in areas already determined to be jurisdictional wetland. The rain gauges and monitoring gauges recorded daily readings of rainfall and depth to groundwater, respectively.

The daily rainfall for the site is recorded from a combination of two sources. Prior to June, the average of the daily rainfall recorded by rain gauges located in Clinton was used; this rainfall data is provided by the NC State Climate Office. Since June, the rainfall data was acquired from a new onsite rain gauge.

¹ Natural Resources Conversation Service, Soil Survey of Sampson County, North Carolina, p.79.

BULL FARM MITIGATION SITE

SAMPSON COUNTY

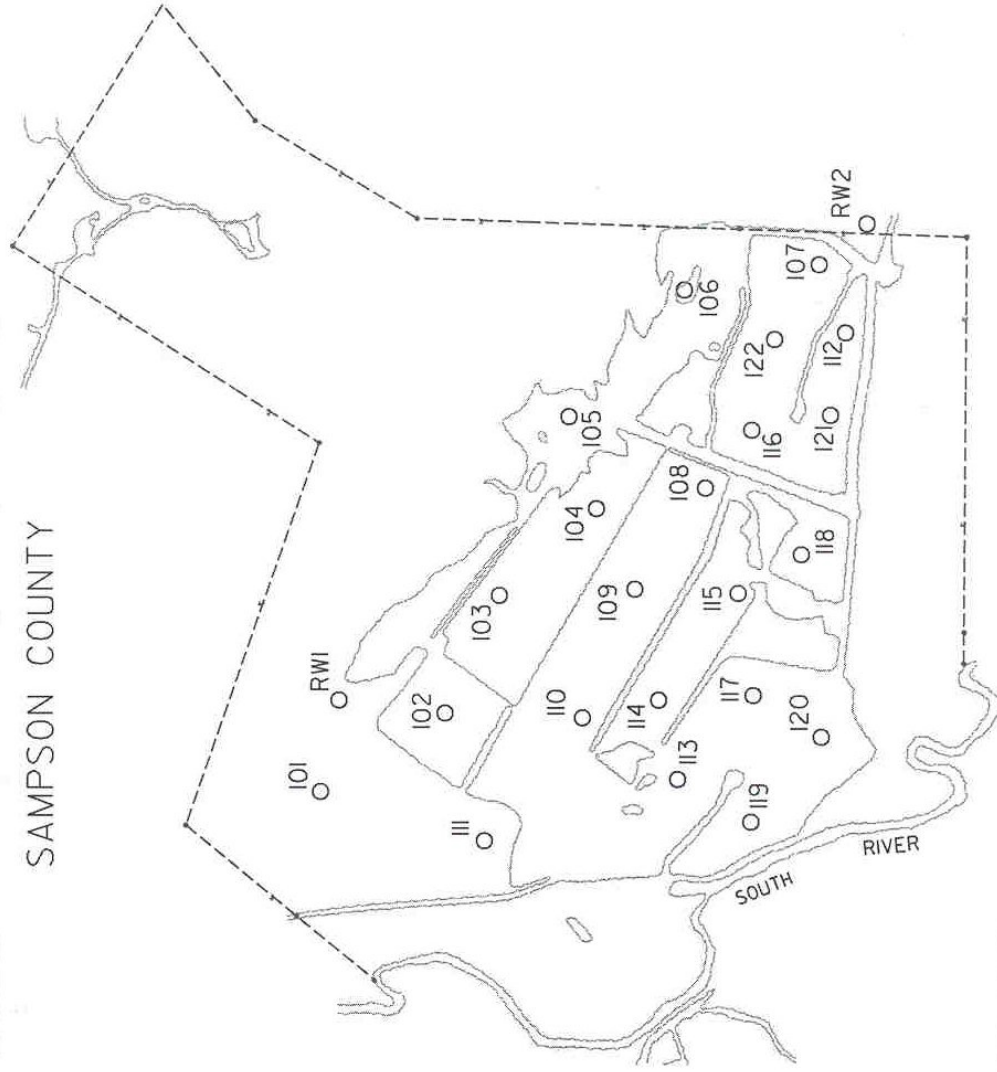


FIGURE 2: MONITORING GAUGE LOCATIONS

2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined for each groundwater gauge. This number was converted into a percentage of the 237-day growing season. Table 1 presents the results for the 2000 growing season. An asterisk * in Table 1 denotes areas that are considered “reference wetlands sites”, as was established in the mitigation planning report.

Appendix A contains a plot of the groundwater depth for each monitoring gauge. The maximum number of consecutive days that the gauge met success above this 12-inch depth is noted on each graph. Graph data determined to be erroneous was omitted; therefore, some gaps appear in the plots.

Precipitation events are included on each graph as bars.

Table 1
2000 HYDROLOGIC MONITORING RESULTS –
(MARCH 18 – NOVEMBER 11)

Monitoring Gauge	< 5% (< 12 dy)	5 - 8% (12-18 dy)	8 – 12.5% (19-29 dy)	> 12.5% (>30 dy)	Actual %	Success Dates
MW-101				✓	22.2	3/18 – 5/9
MW-102		✓			5.8	3/18 – 3/31
MW-103				✓	15.9	3/21 – 4/27
MW-104				✓	100	3/18 – 11/11
MW-105				✓	58.2	3/18 – 8/3
MW-106				✓	100	3/18 – 11/11
MW-107				✓	84.1	3/18 – 10/4
MW-108				✓	100	3/18 – 11/11
MW-109				✓	47.3	7/22 – 11/11
MW-110			✓		8.8	3/18 – 4/7
MW-111				✓	21.8	3/18 – 5/8
MW-112			✓		12.1	4/9 – 5/7
MW-113				✓	25.1	3/8 – 5/16
MW-114				✓	22.1	3/18 – 5/9
MW-115				✓	100	3/18 – 11/11
MW-116				✓	100	3/18 – 11/11
MW-117				✓	100	3/18 – 11/11
MW-118				✓	100	3/18 – 11/11
MW-119	✓				0.4	3/26
MW-120				✓	25.5	8/25 – 10/24
MW-121				✓	24.7	8/19 – 10/16
MW-122				✓	100	3/18 – 11/11
*RW-1				✓	24.7	8/19 – 10/16
*RW-2				✓	47.3	7/22 – 11/11

Figure 3 is a graphical representation of the hydrologic monitoring results for this year. A blue dot represents wetland hydrology for more than 12.5% of the season; a red dot indicates hydrology between 8% and 12.5%; a green dot represents hydrology between 5% and 8%.

For this period from March through November, eighteen of the twenty-two gauges (reference gauges were not included in the totals) met jurisdictional hydrologic success of at least 12.5% during the growing season. Conversely, one only gauge met hydrology of less than 5% of the growing season.

BULL FARM MITIGATION SITE SAMPSON COUNTY

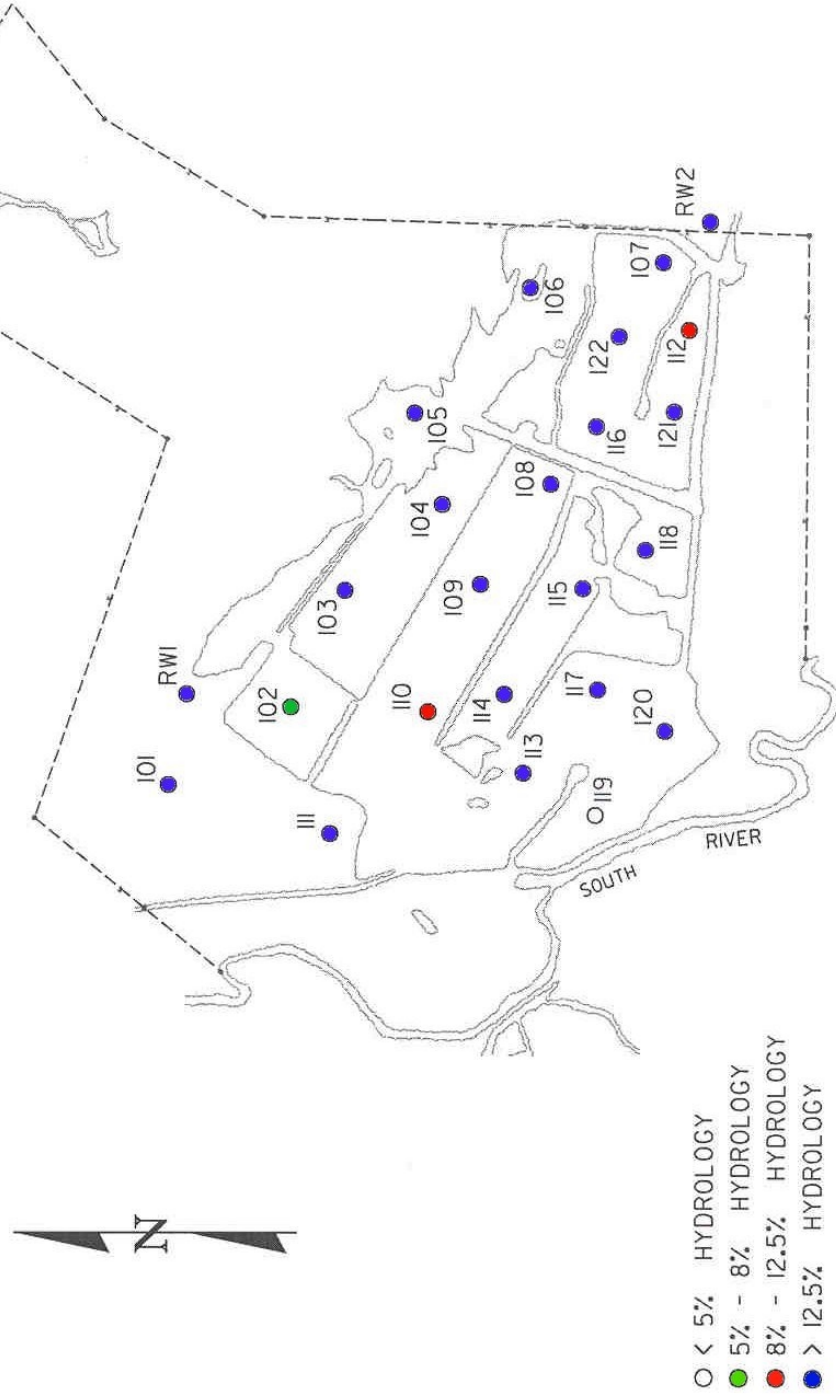


FIGURE 3: 2000 HYDROLOGIC RESULTS

Table 2 gives a comparison of the last four years to show the number of gauges that met hydrology for each of the categories from Table 1.

Table 2
HYDROLOGIC MONITORING RESULTS FOR 1997 – 2000

Year	< 5% (< 12 dy)	5 - 8% (12-19 dy)	8 - 12.5% (20-30 dy)	> 12.5% (>31 dy)
1997	8 gauges	2 gauges	3 gauges	9 gauges
1998	2 gauges	1 gauges	2 gauges	17 gauges
1999 (Mar.-Aug.)	4 gauges	0 gauges	3 gauges	15 gauges
1999 (Sept. – Nov.)	0 gauges	0 gauges	2 gauges	20 gauges
2000	1 gauges	1 gauges	2 gauges	18 gauges

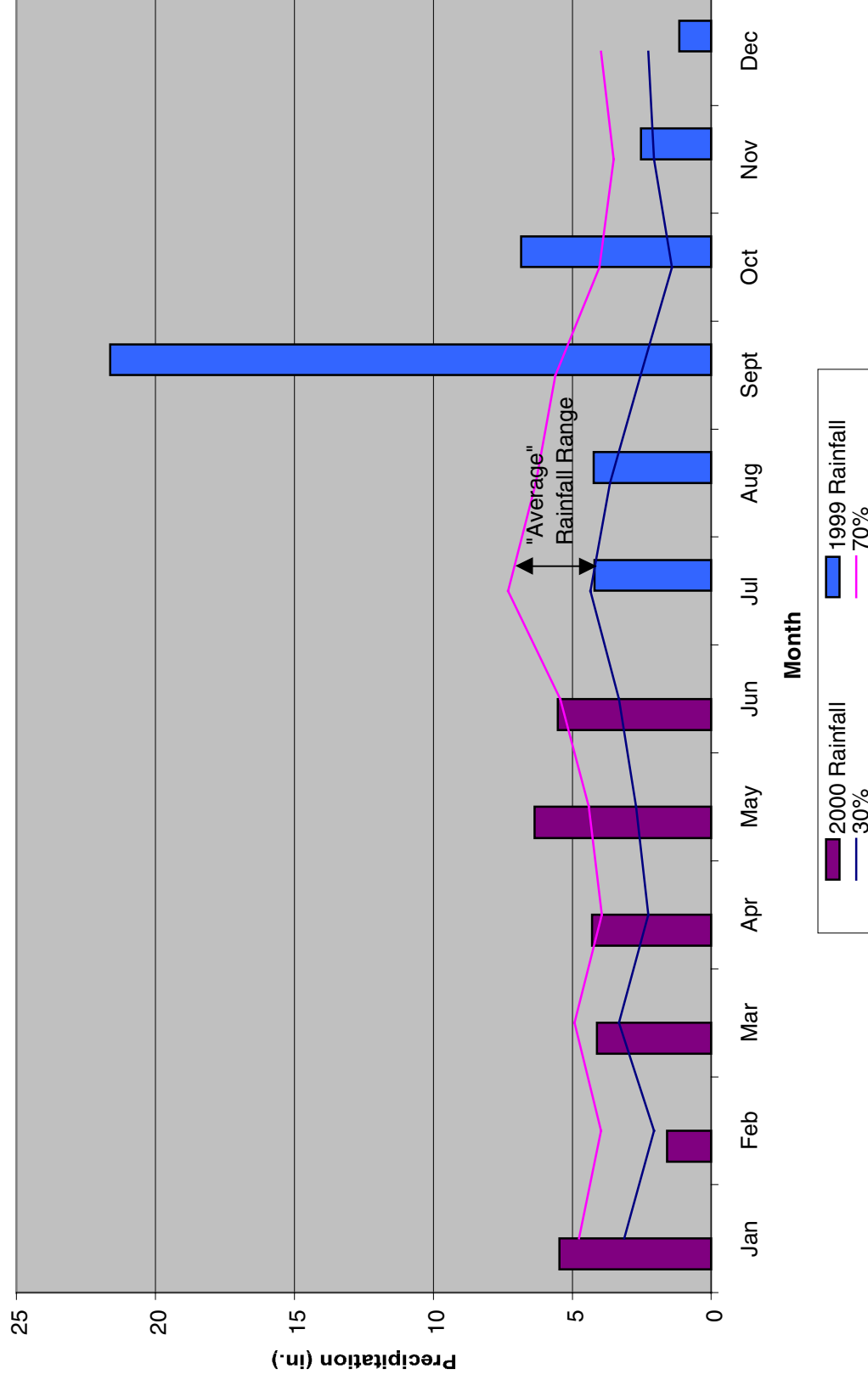
Note: Total number of gauges in each category does not include reference gauges.

2.3.2 Climatic Data

Figure 4 represents an examination of the local climate in comparison with historical data in order to determine whether 2000 was “average” in terms of climate conditions. The figure compares the rainfall from 2000 with that of historical rainfall (data collected between 1937 and 1999). All rainfall data was collected from the NC State Climate Office. The graph shows 1999 rainfall totals from September to December; the graph also shows 2000 rainfall totals through June 2000. Rainfall data for July through December 2000 will be presented in the 2001 Annual Monitoring Report.

January and May 2000 had above normal precipitation. September 1999 had especially high precipitation due to hurricane activity. Conversely, December 1999 and February 2000 were lower than normal. Overall, 2000 was an average year in terms of precipitation amounts.

**FIGURE 4: Bull Farm 30-70 Percentile Graph
(Sampson County)**



3.0 Conclusions/ Recommendations

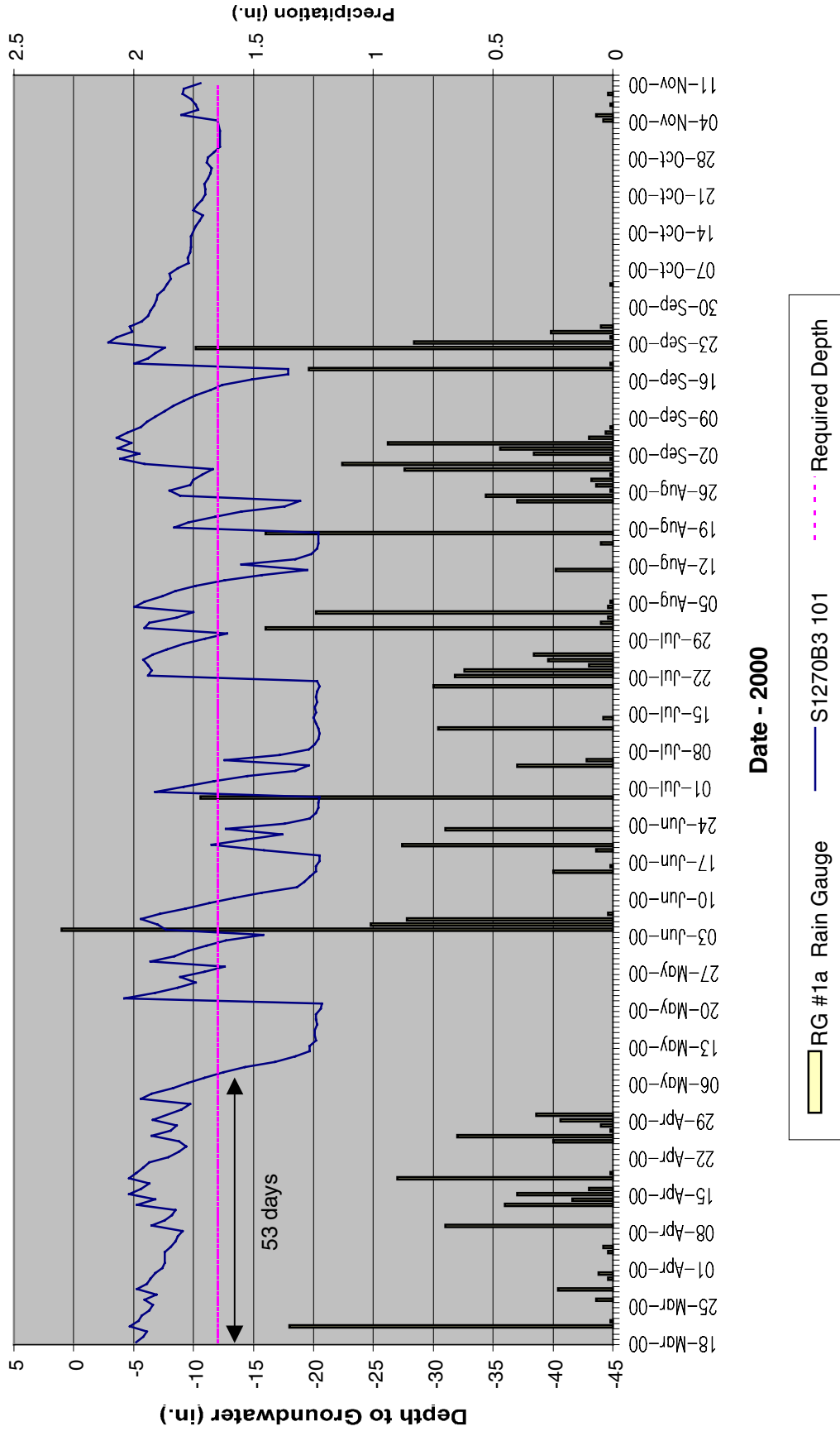
In 1997, nine of twenty-two monitoring gauges indicated optimum hydrologic success of 12.5% or better during the growing season. In the current year, eighteen gauges met the required 12.5% or better success. The site has shown a steady hydrological improvement.

Vegetation monitoring was discontinued in 1999. The areas around Gauge 102 and 119 are not showing hydrological success; based on existing conditions on the site, NCDOT doesn't anticipate improvements in these areas. Therefore, NCDOT proposes to discontinue monitoring and close out the site, but remove a yet to be determined credits from the site due to the lack of success around Gauges 102 and 119.

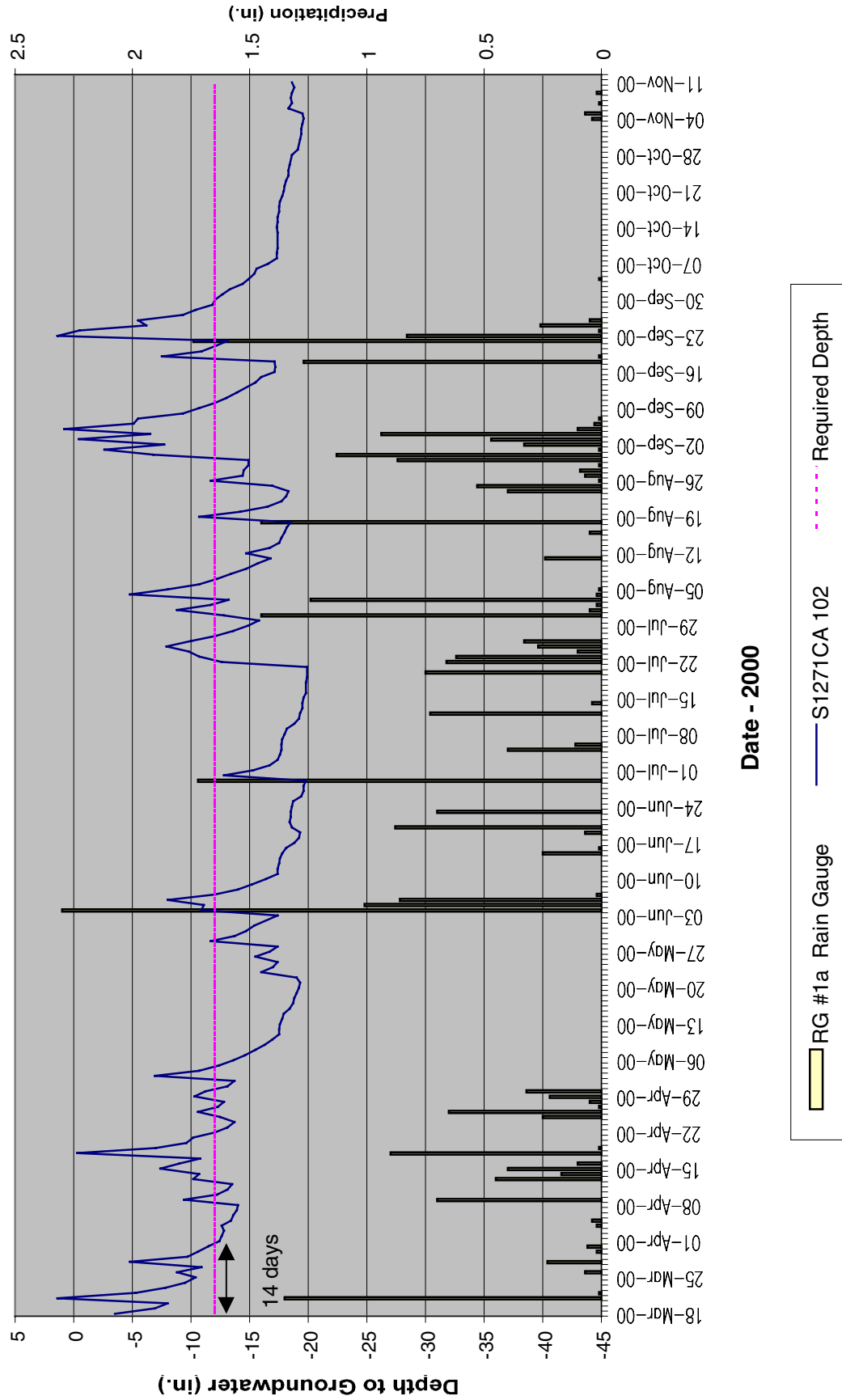
APPENDIX A

DEPTH TO GROUNDWATER GRAPHS

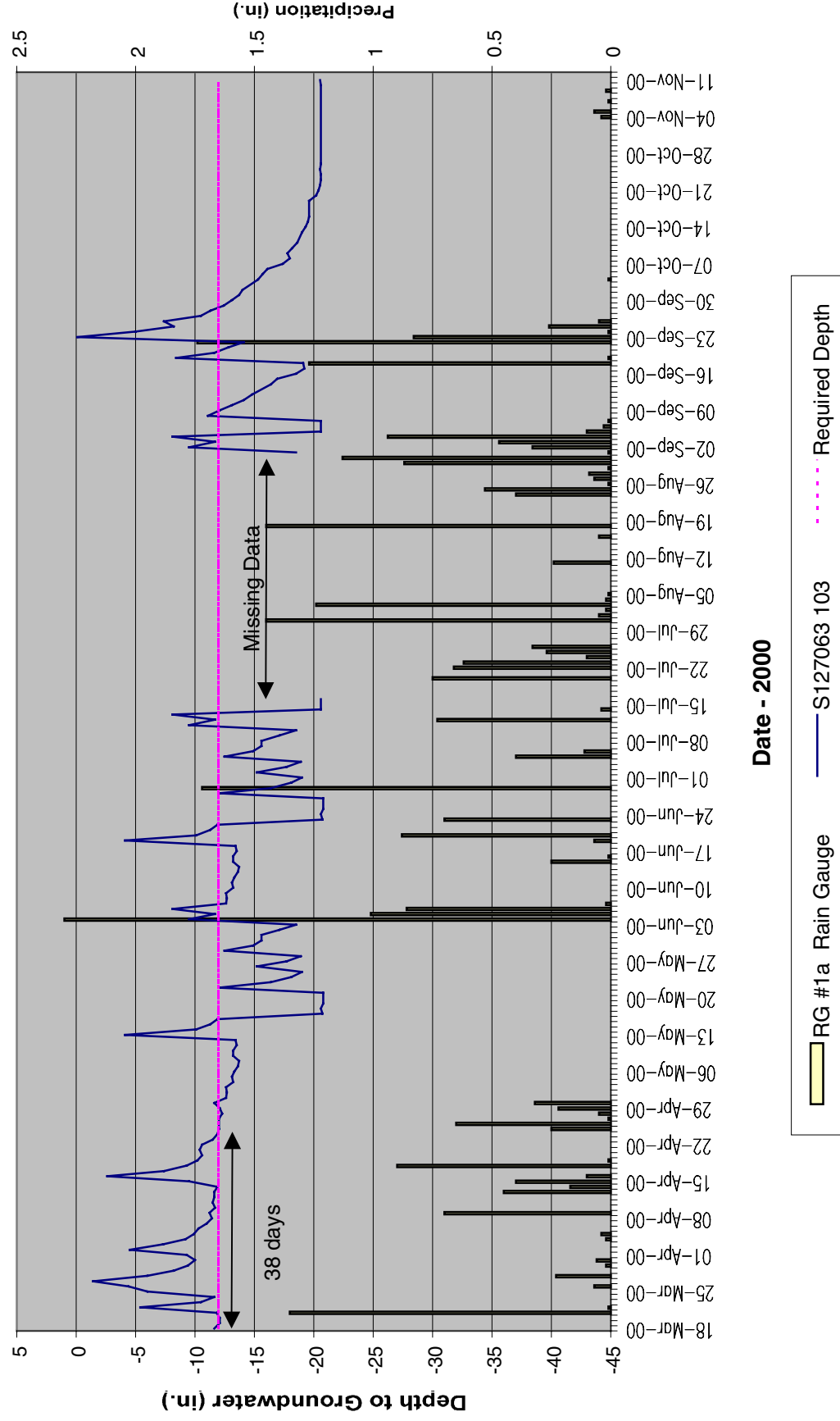
Bull Farm - Well 101



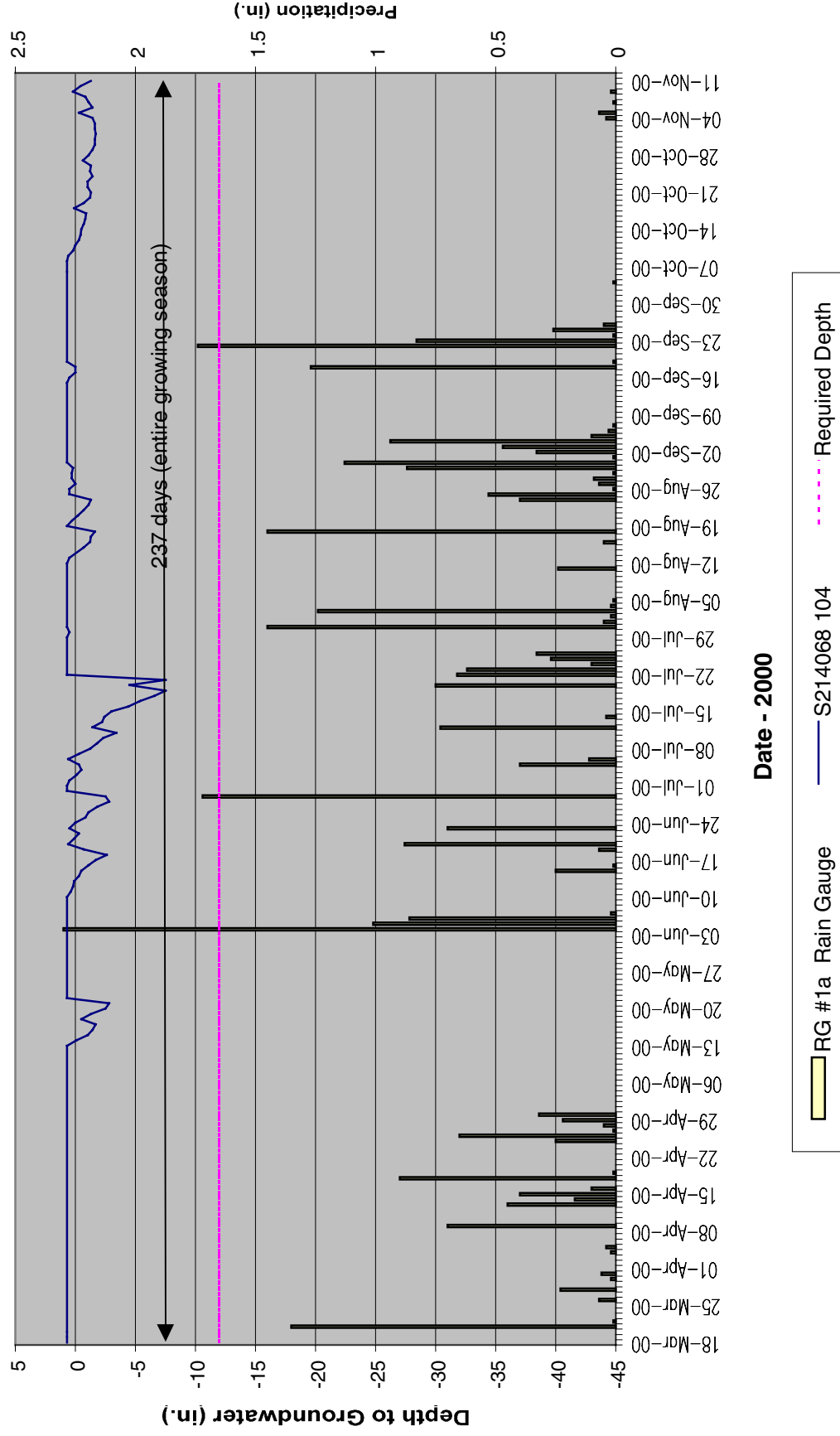
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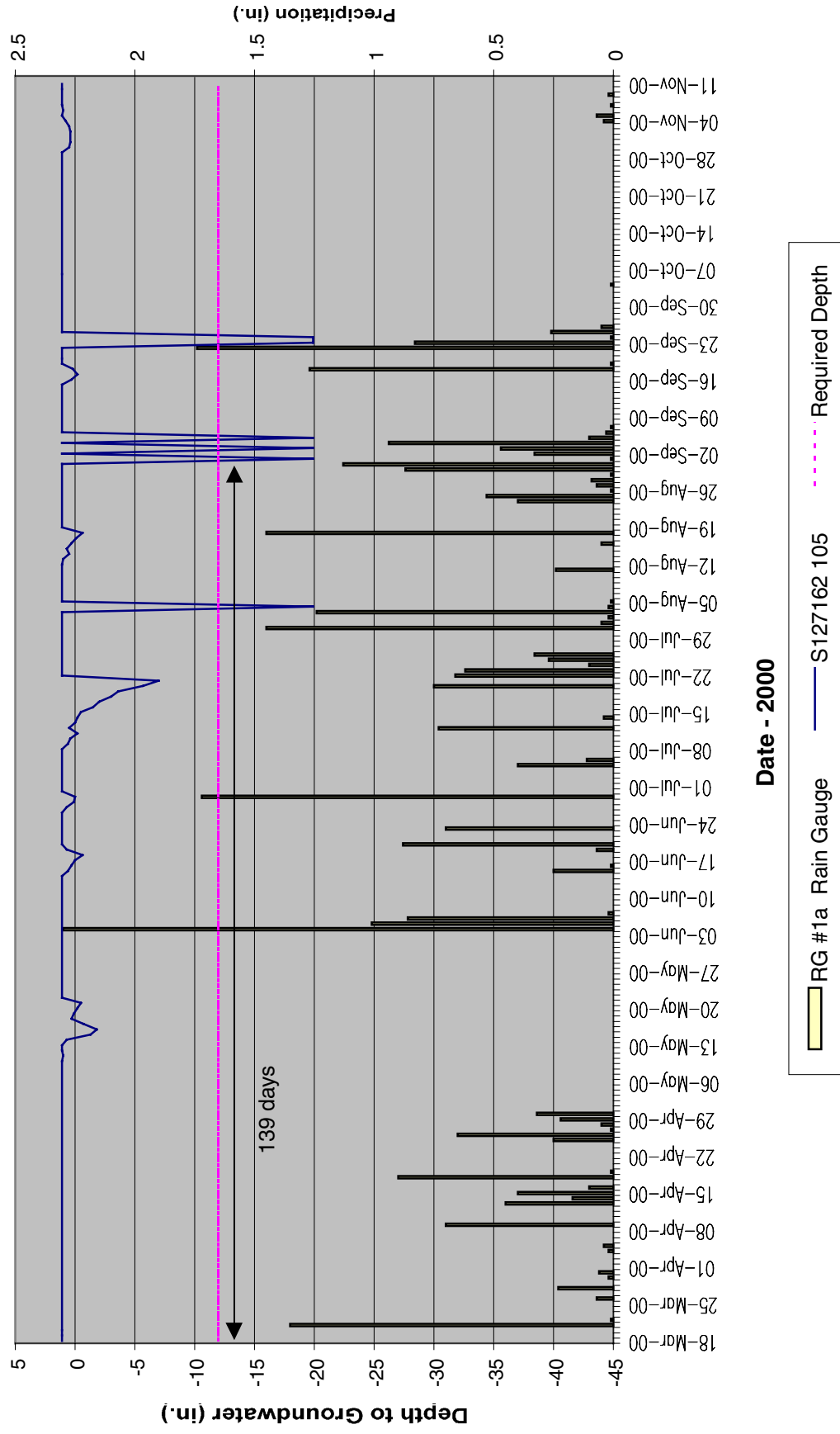
Bull Farm - Well 103



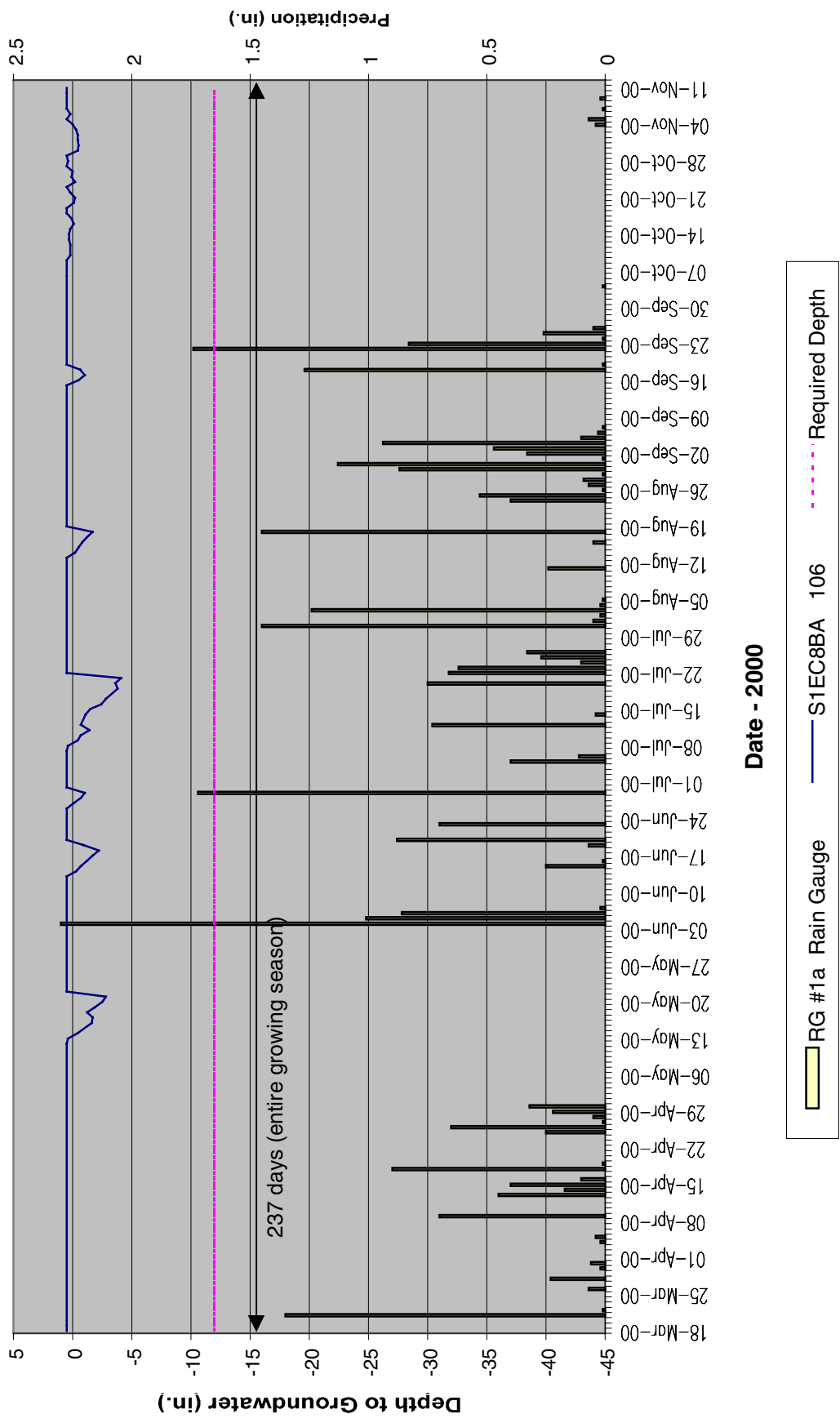
Bull Farm - Well 104



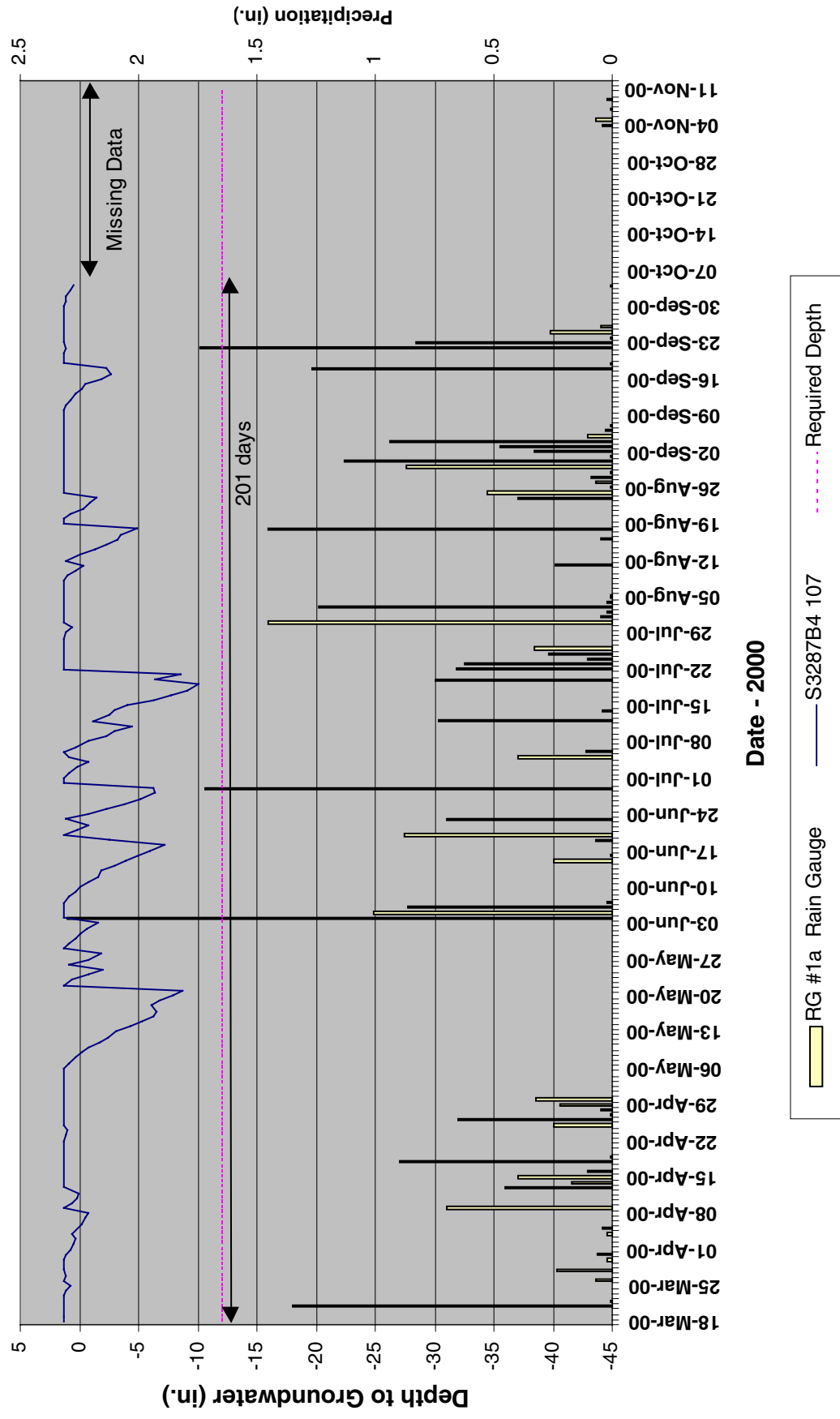
Bull Farm - Well 105



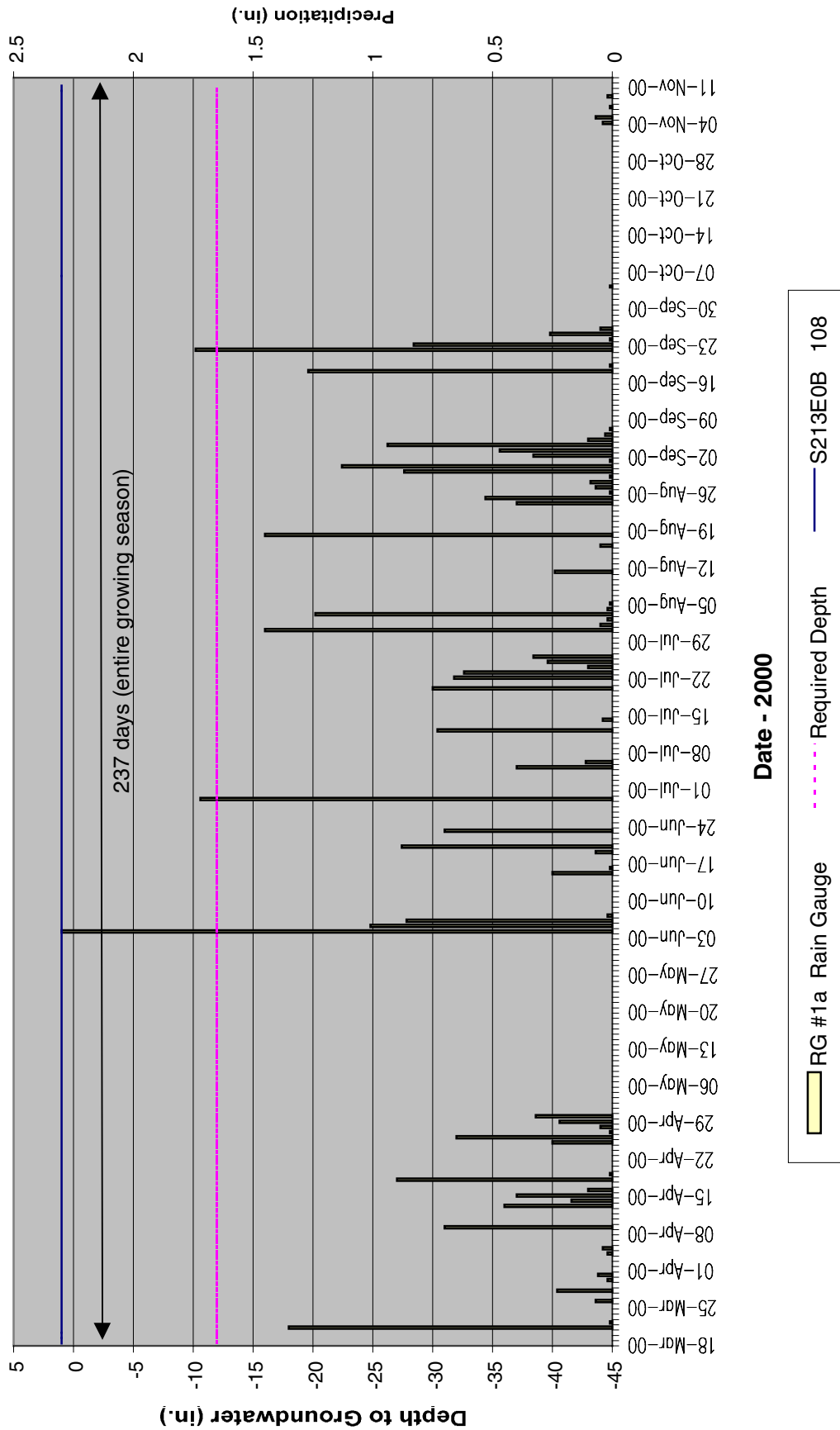
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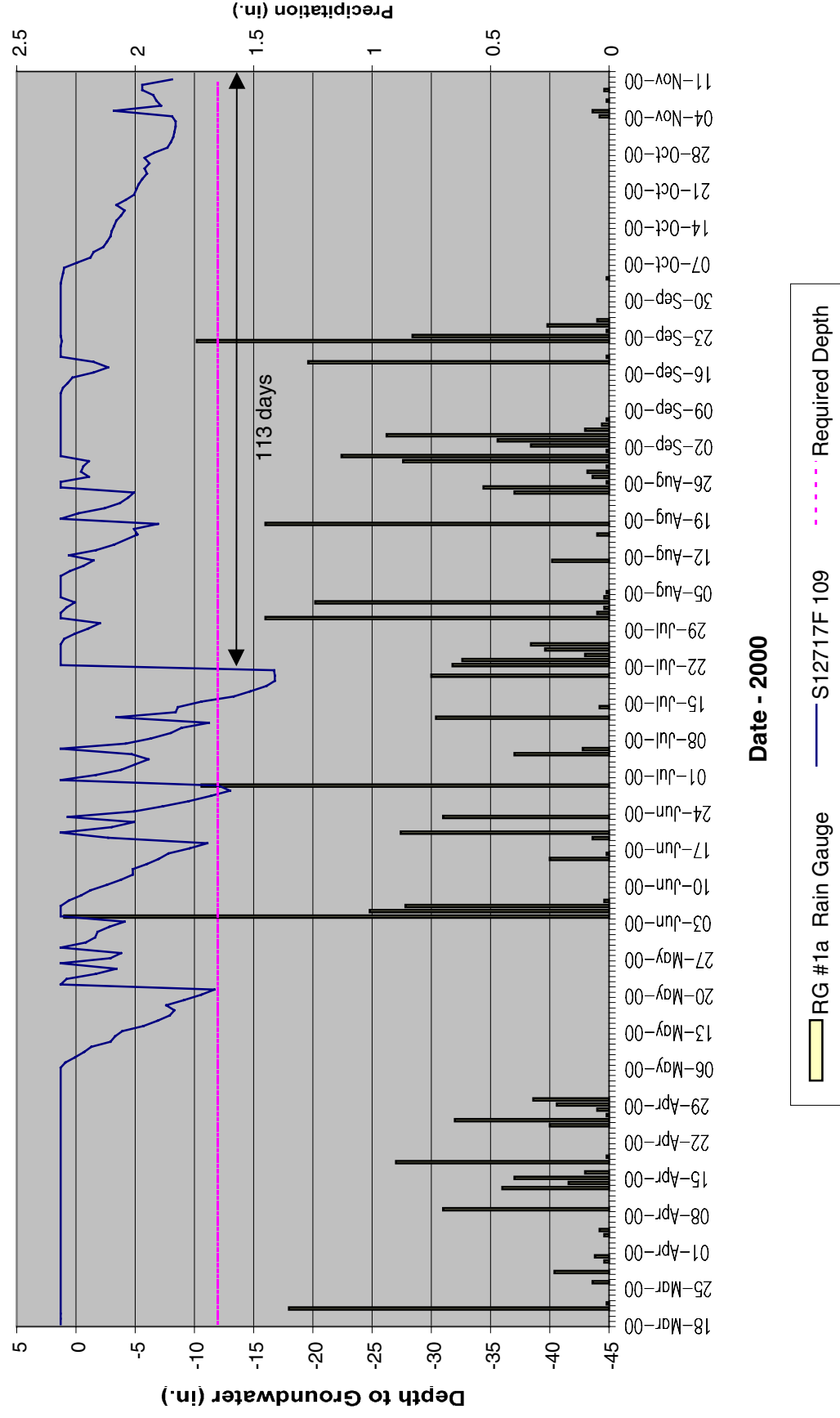
Bull Farm - Well 107



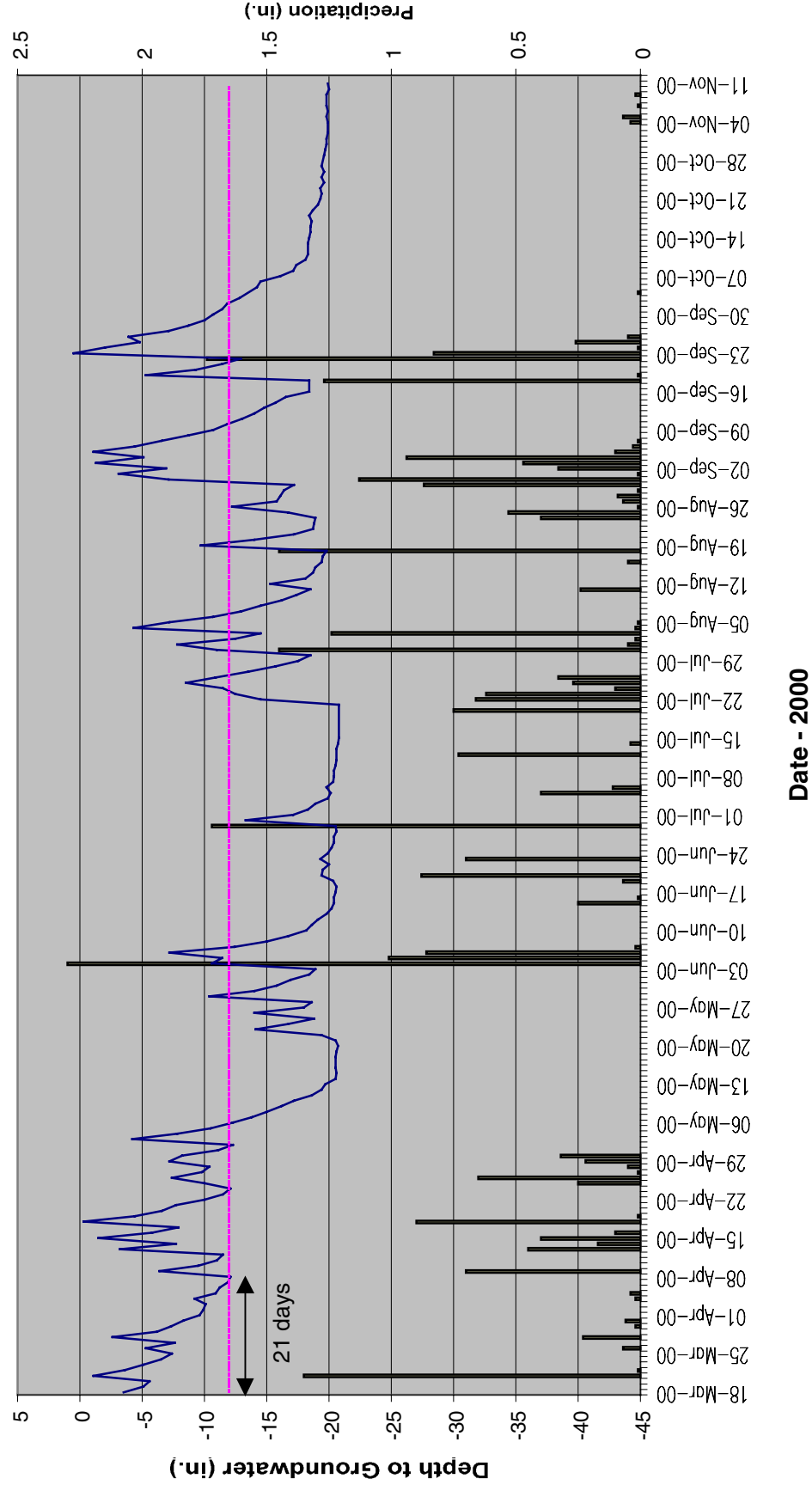
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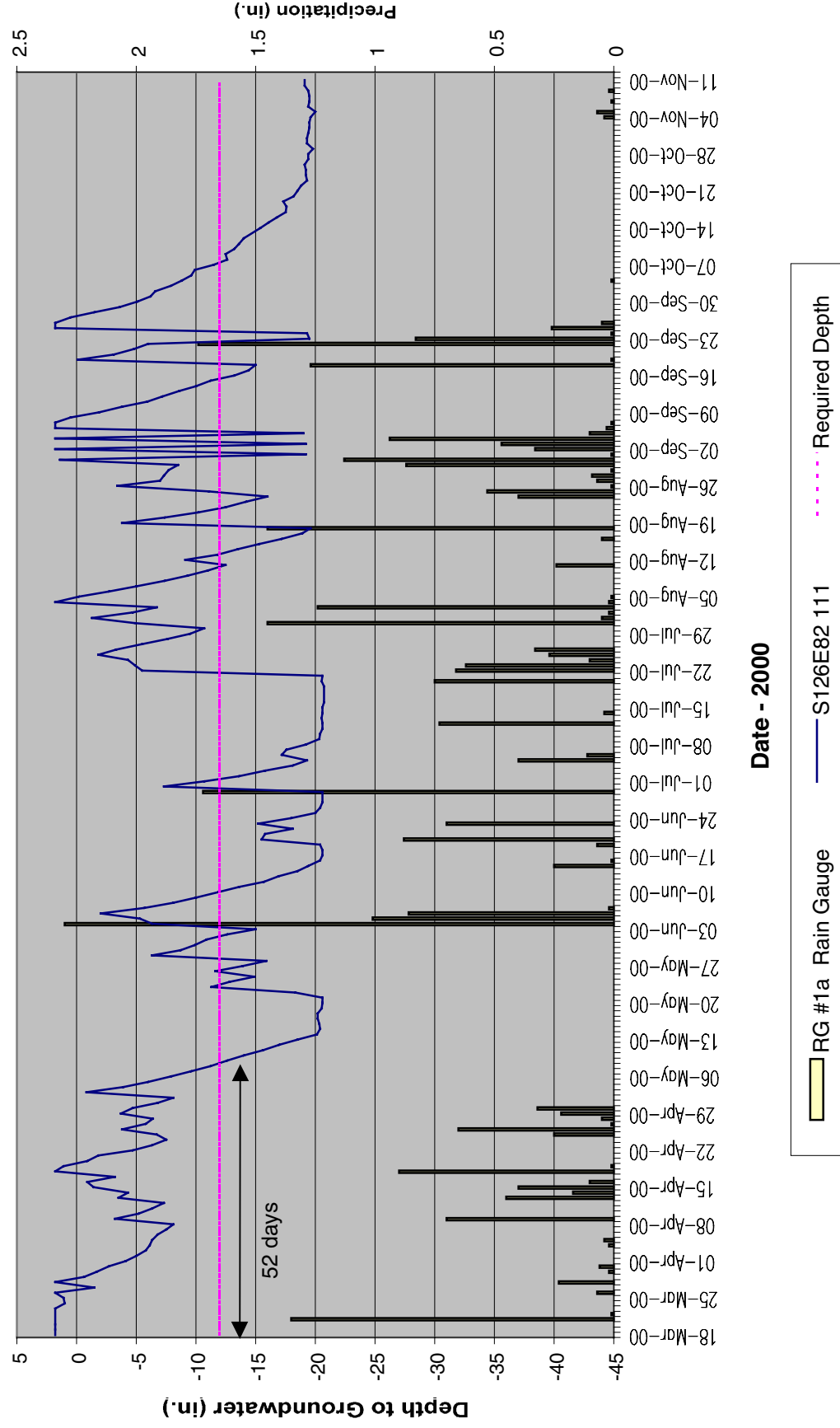
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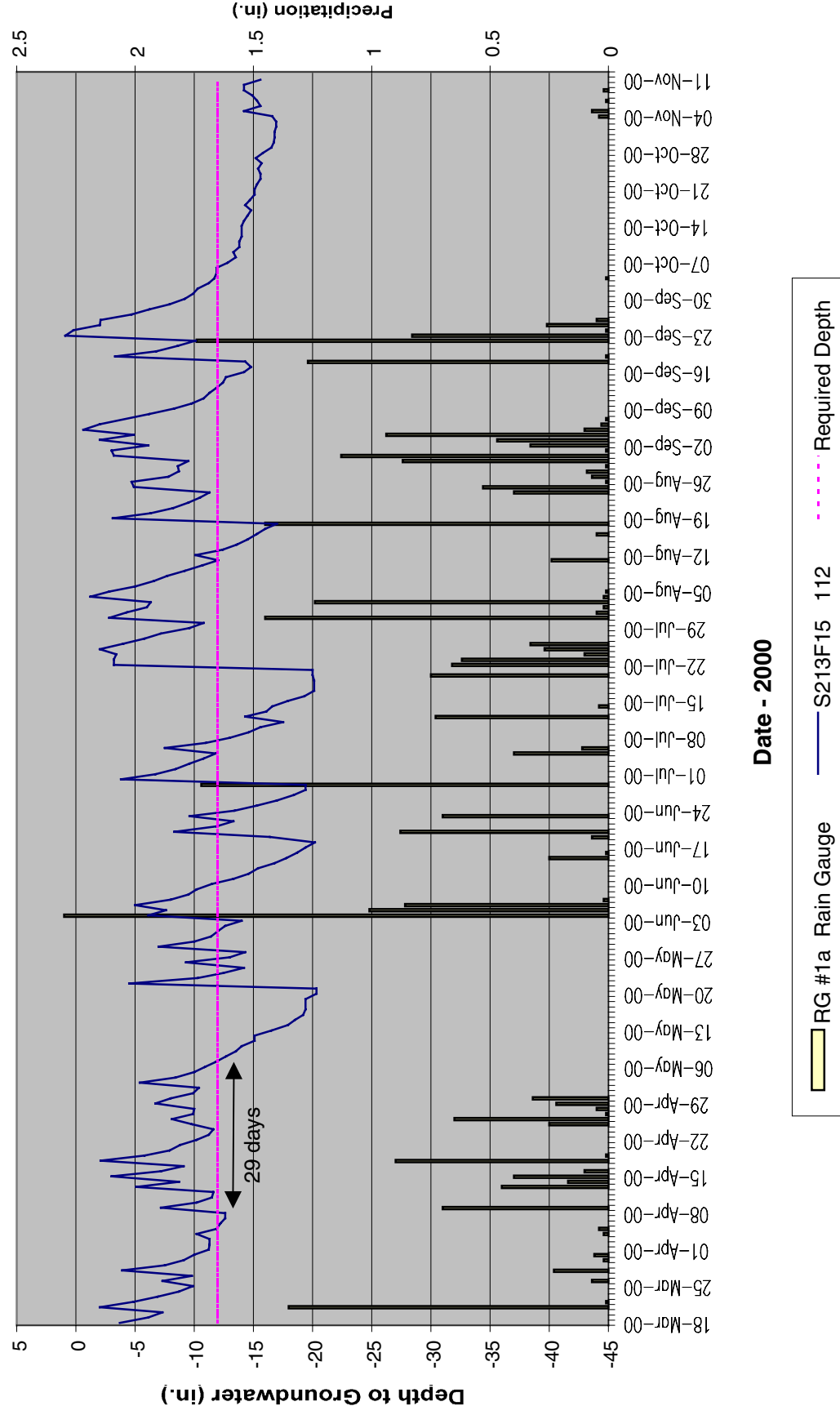
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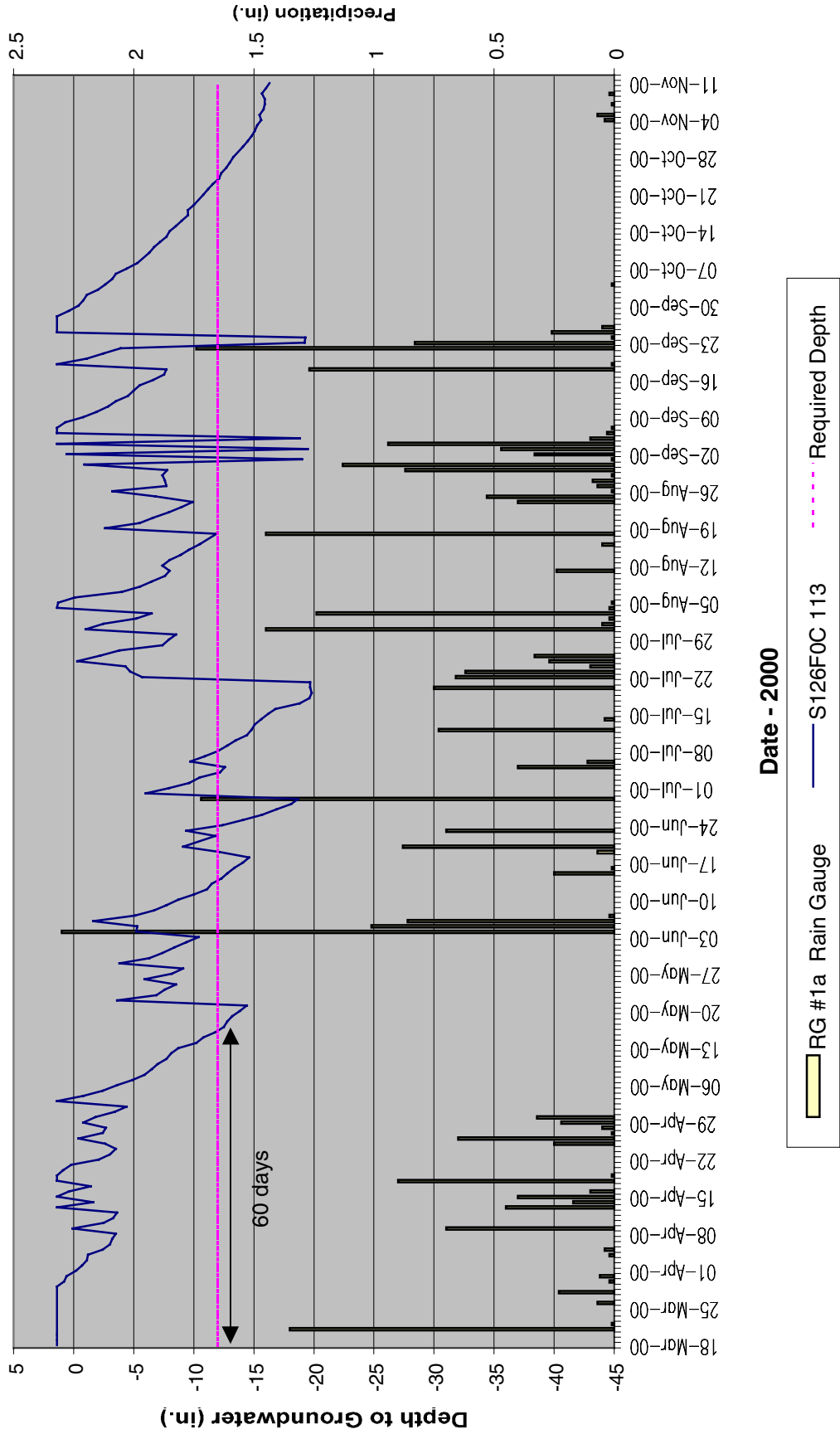
Bull Farm - Well 111



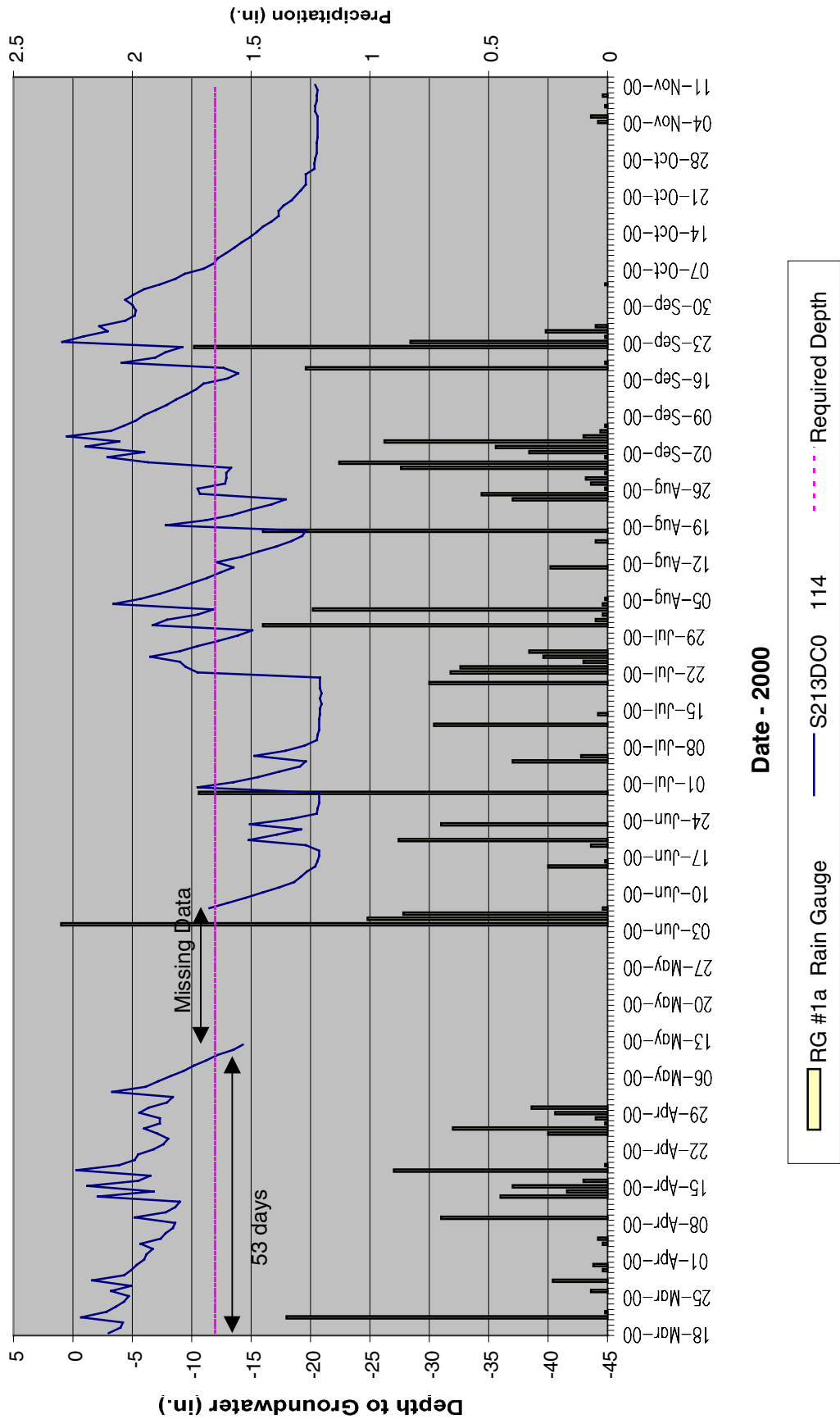
Bull Farm - Well 112



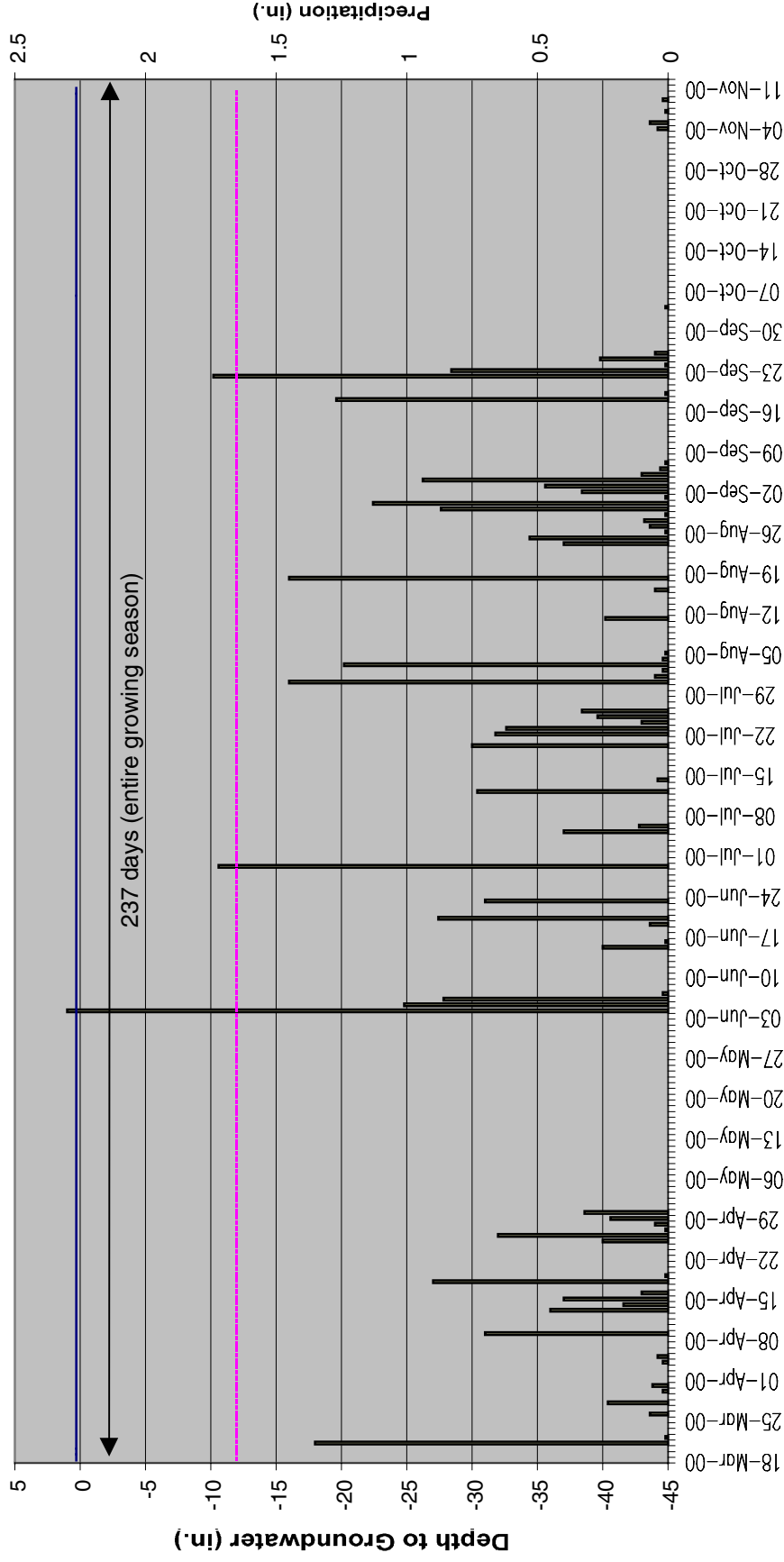
Bull Farm - Well 113



Bull Farm - Well 114



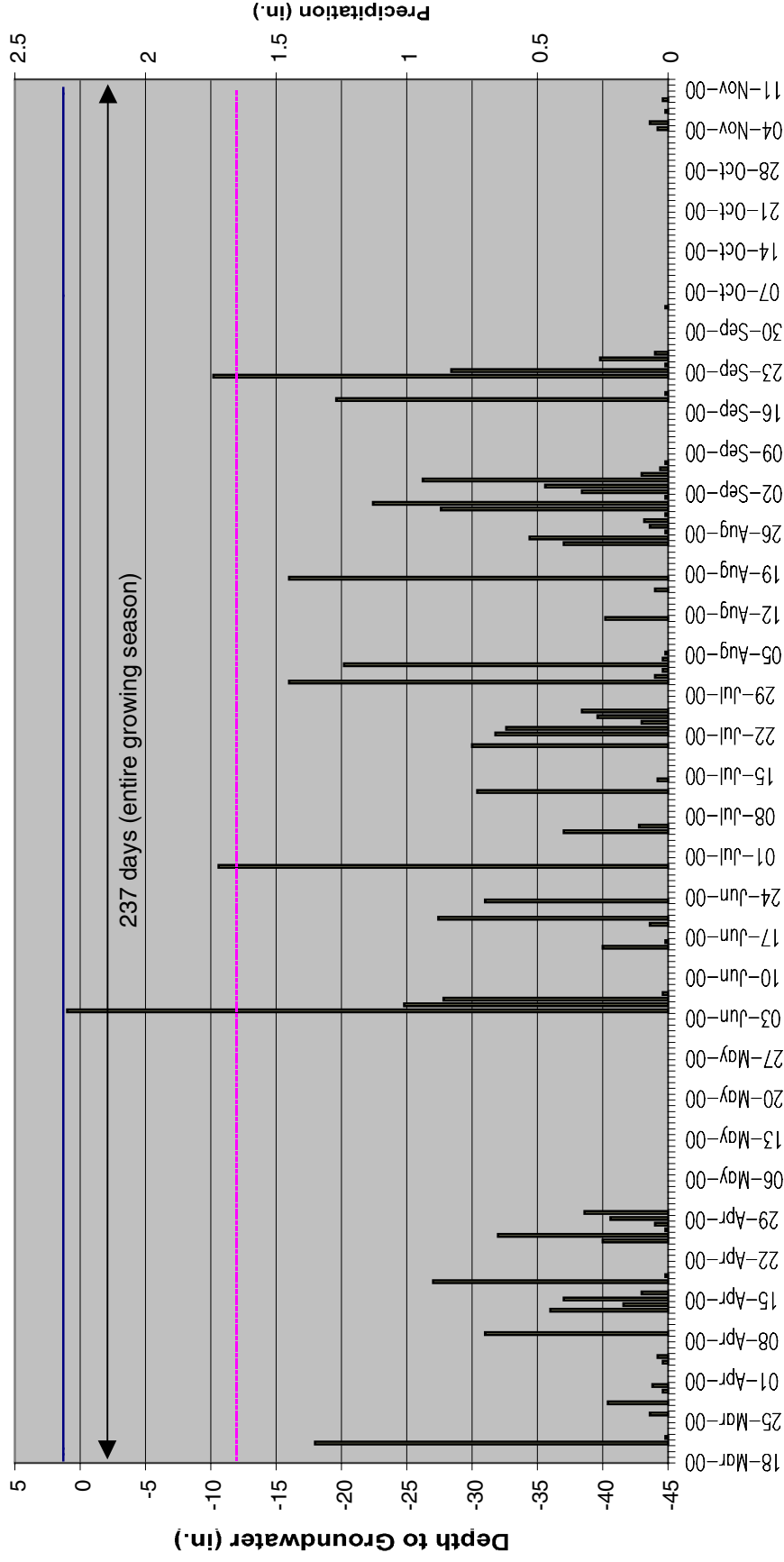
Bull Farm - Well 115



Date - 2000

RG #1a Rain Gauge S158BC0 115 Required Depth

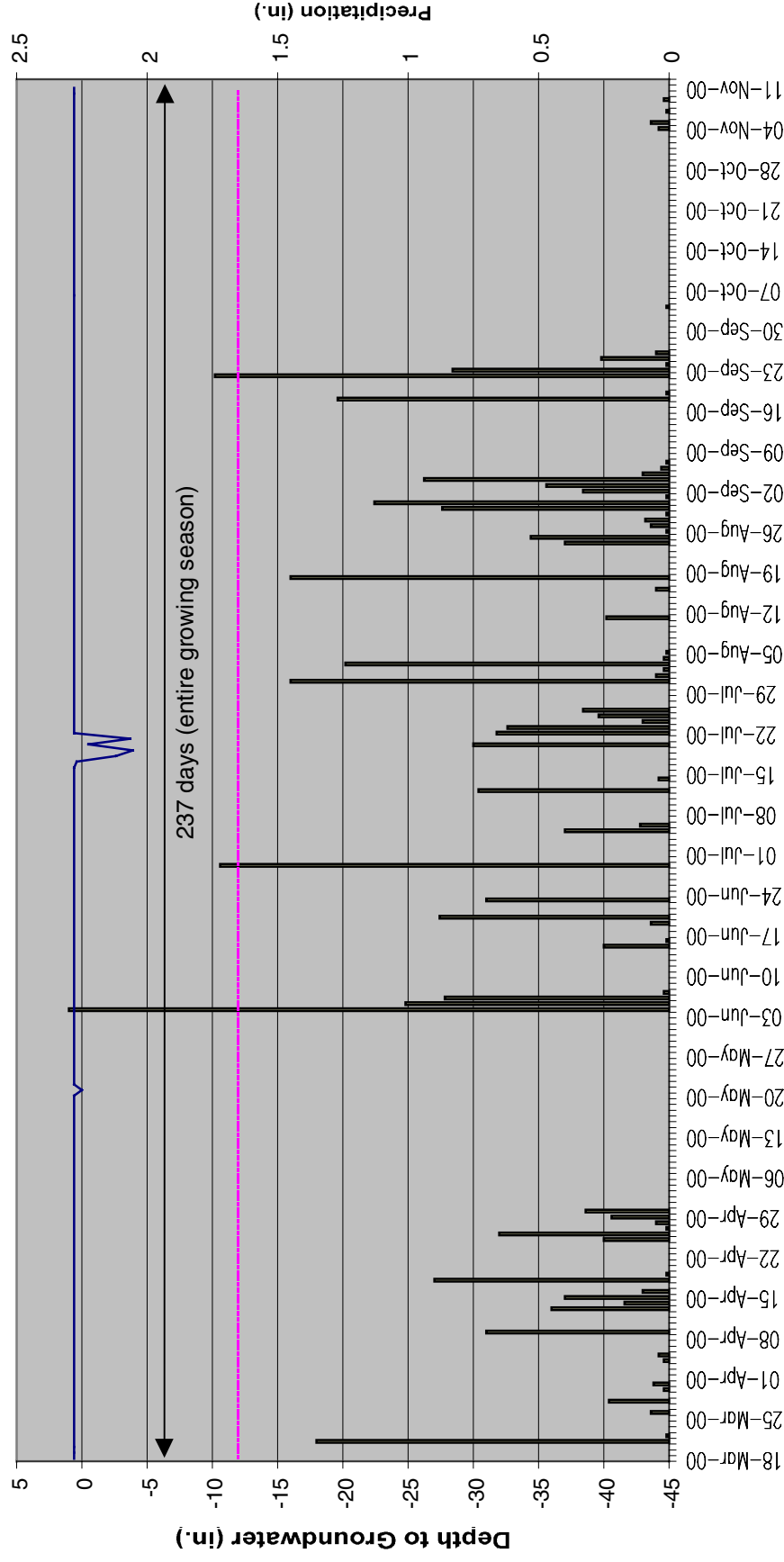
Bull Farm - Well 116



Date - 2000

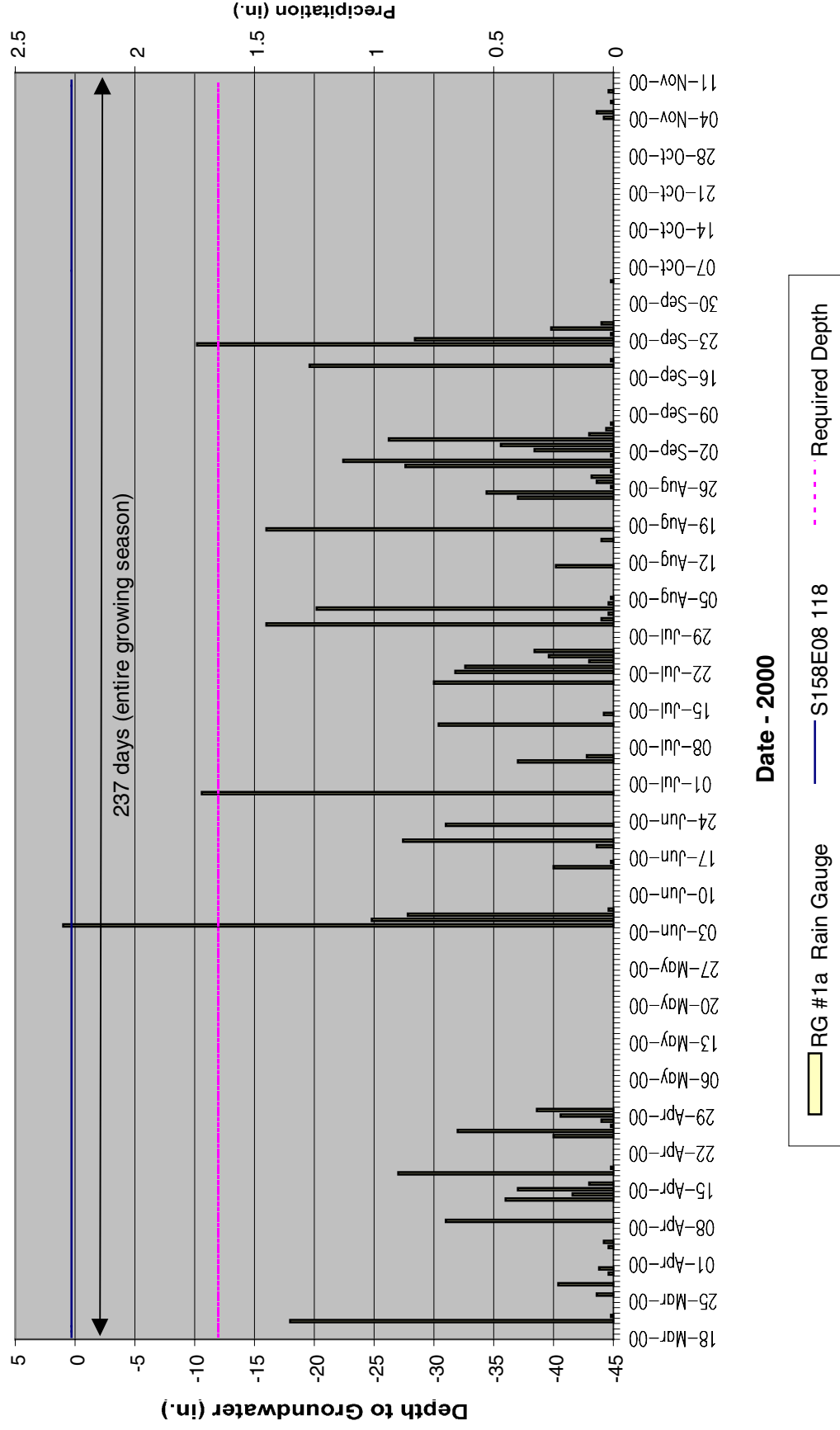
RG #1a Rain Gauge S144E7B 116 Required Depth

Bull Farm - Well 117

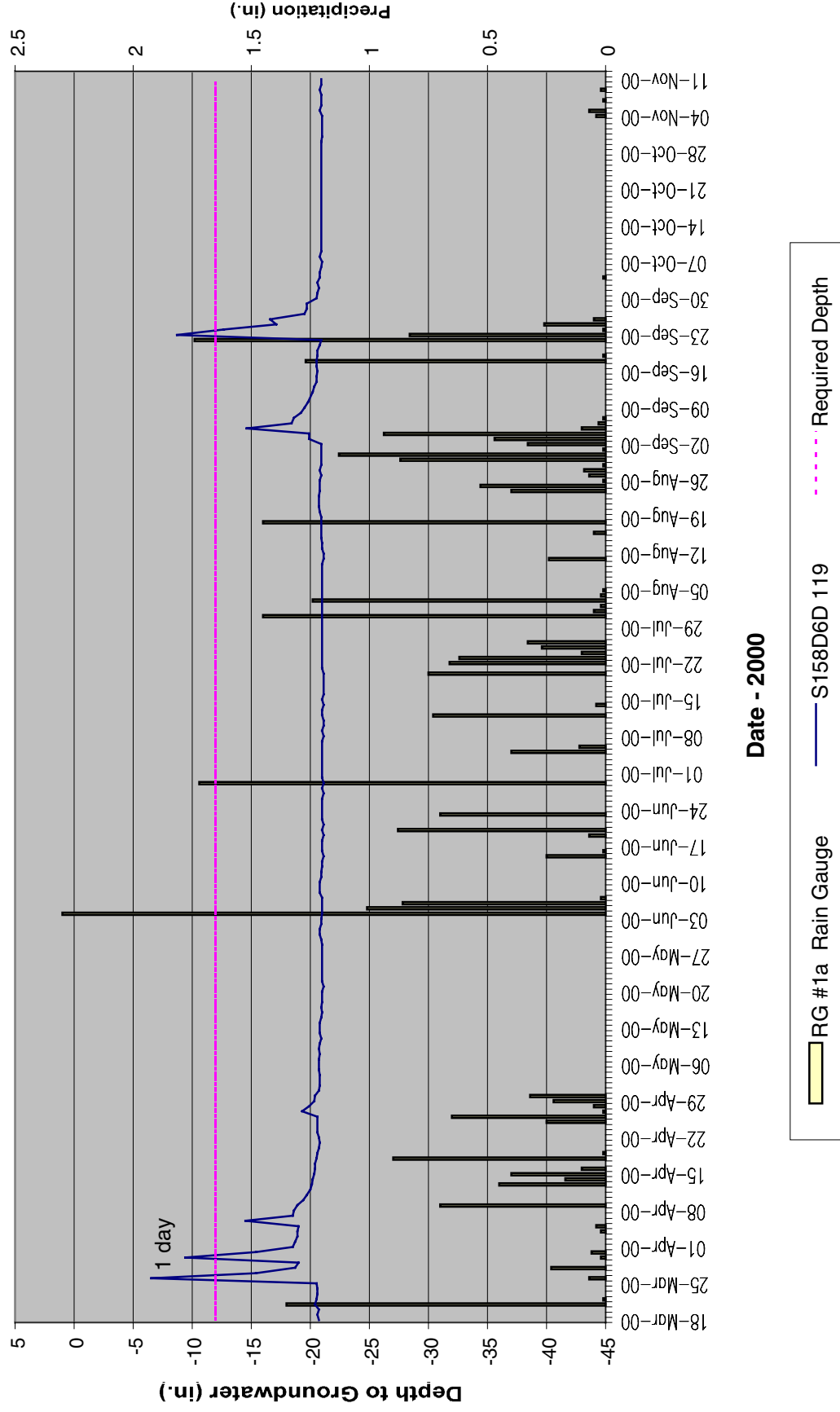


Date - 2000

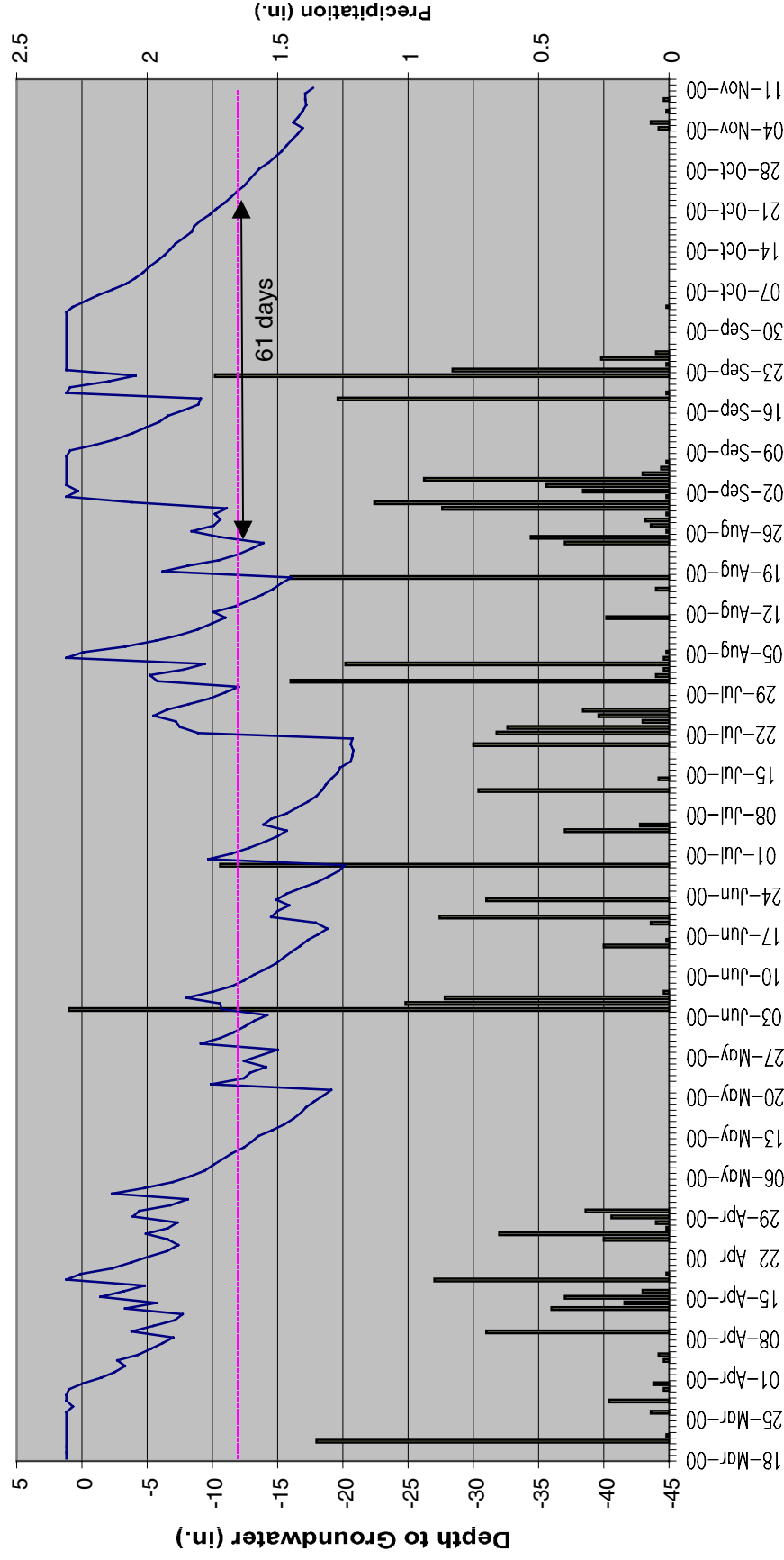
Bull Farm - Well 118



Bull Farm - Well 119

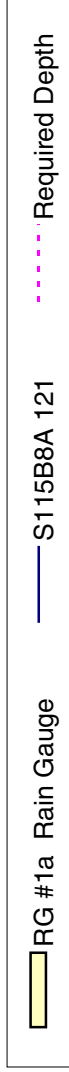
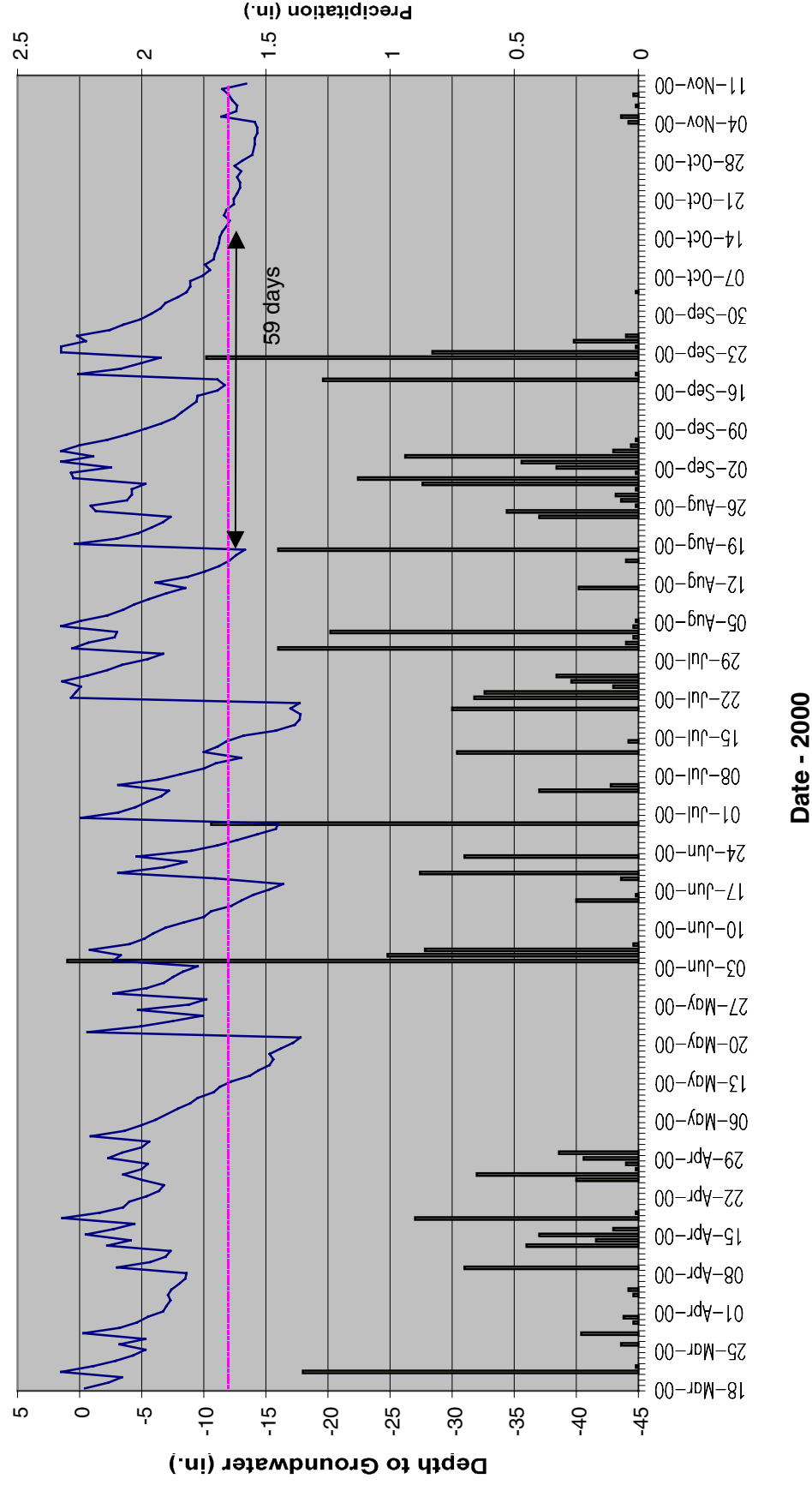


Bull Farm - Well 120

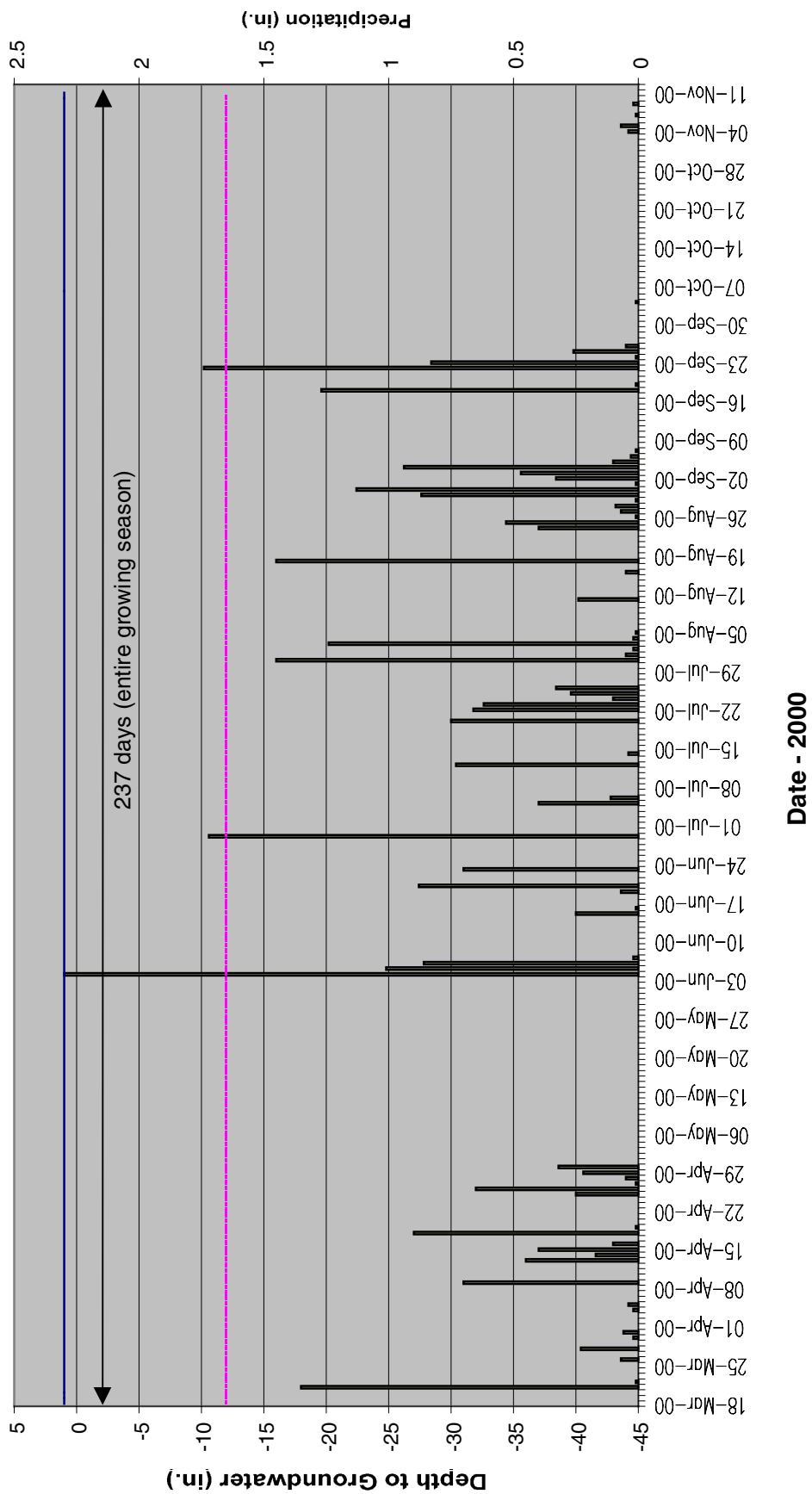


Date - 2000

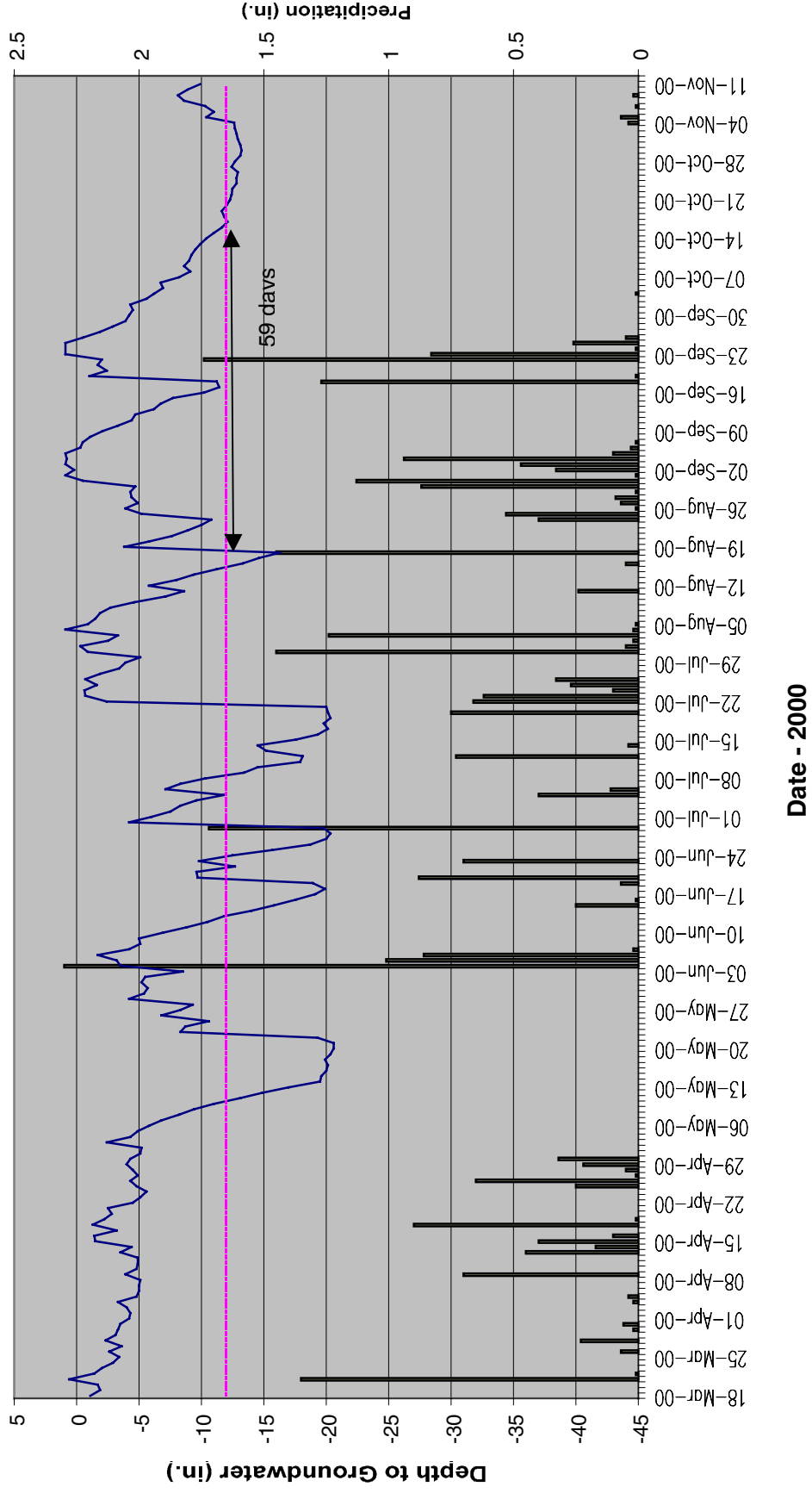
Bull Farm - Well 121



Bull Farm - Well 122



Bull Farm - Well RW#1



Bull Farm - Well RW#2

